

Applicant: Yan Zhou and Seng-Tiong Ho

Title: INTEGRATED PLANAR COMPOSITE COUPLING STRUCTURES  
FOR BI-DIRECTIONAL LIGHT BEAM TRANSFORMATION...

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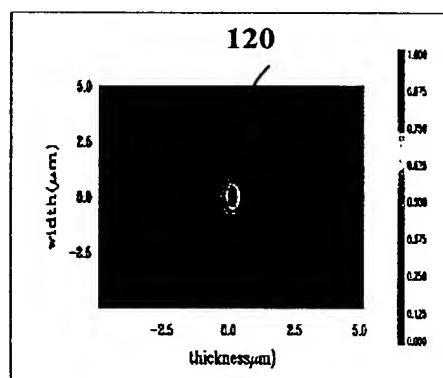
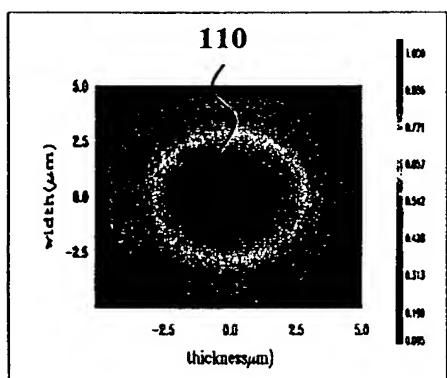
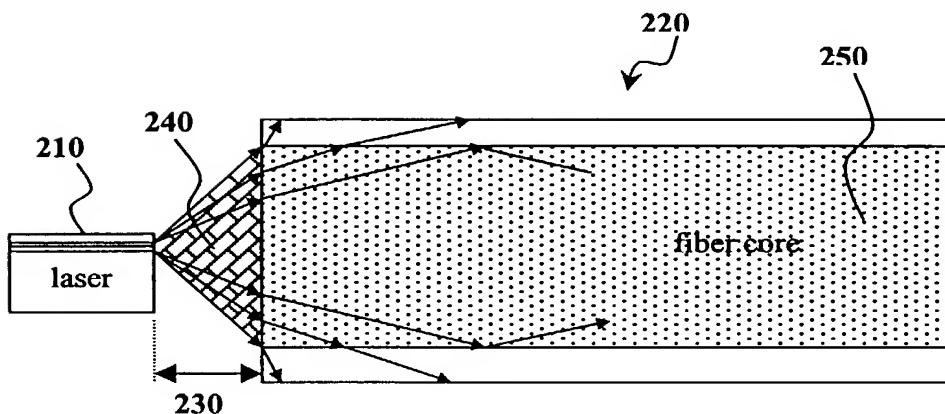


FIG 1 (a)

FIG 1 (b)

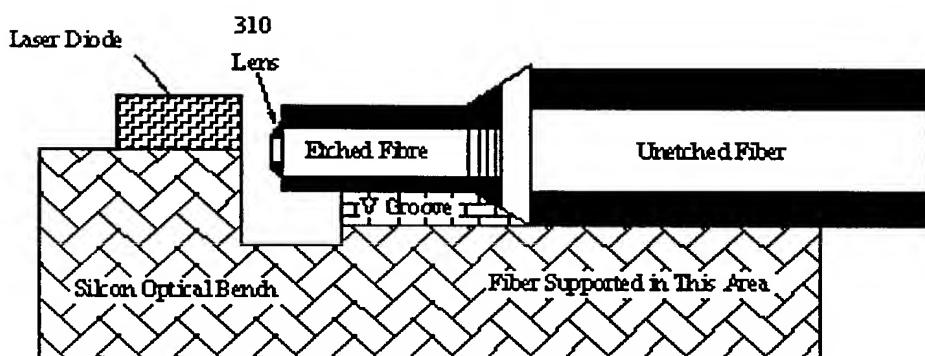
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PRIOR ART

FIG 2

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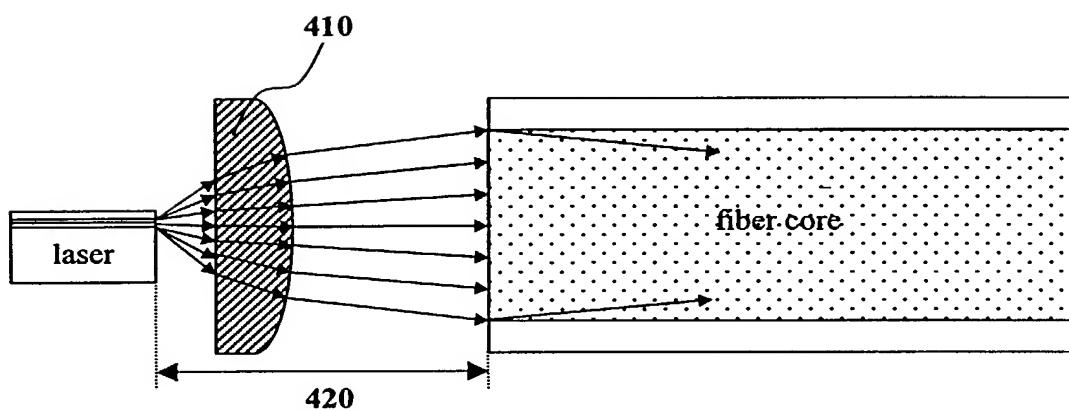


#### PRIOR ART

FIG. 3

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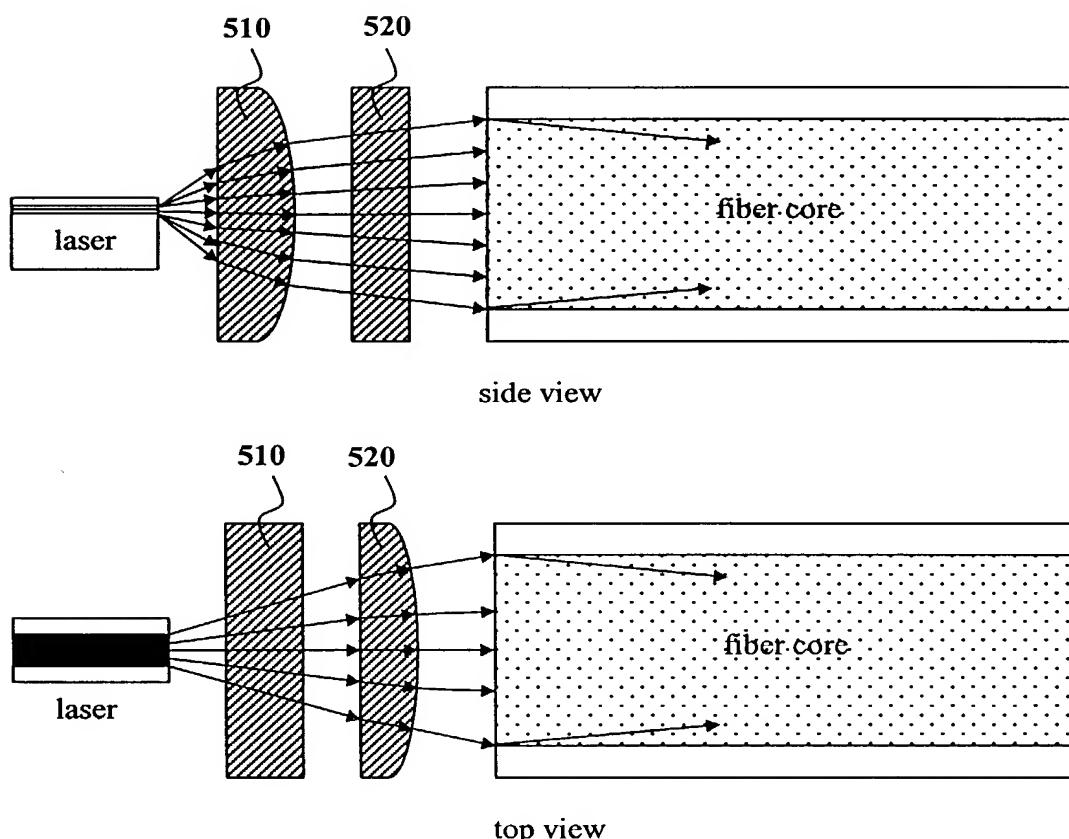


**PRIOR ART**

**FIG. 4**

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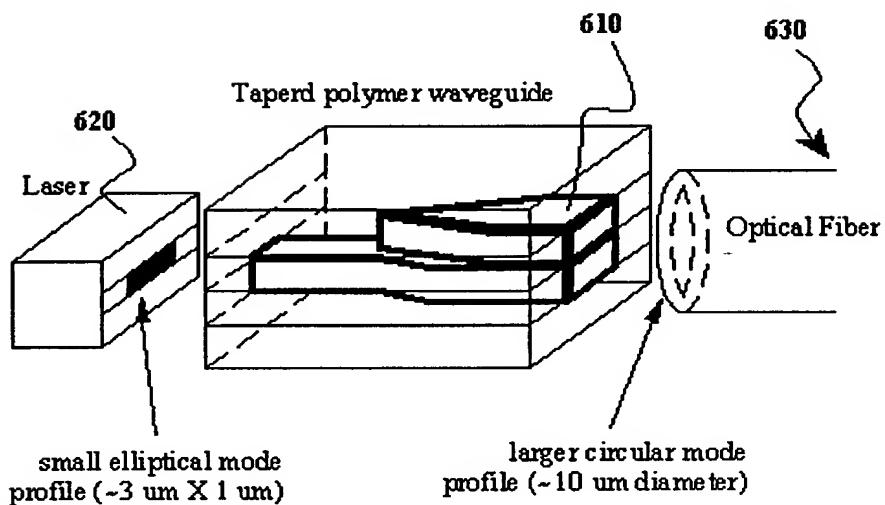


**PRIOR ART**

**FIG. 5**

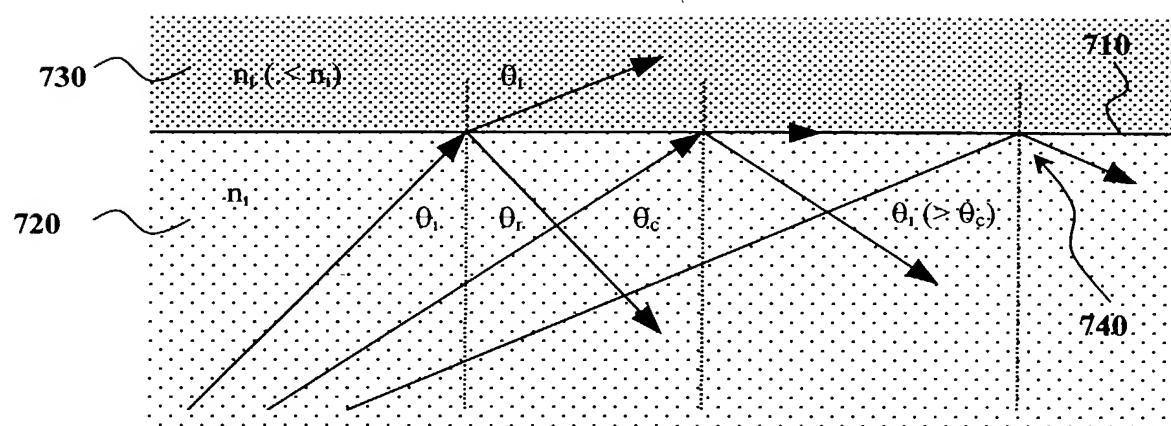
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## PRIOR ART

**FIG. 6**



**FIG 7**

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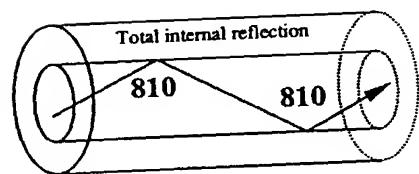


FIG. 8

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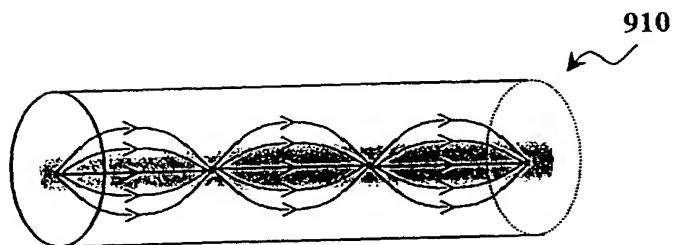


FIG 9

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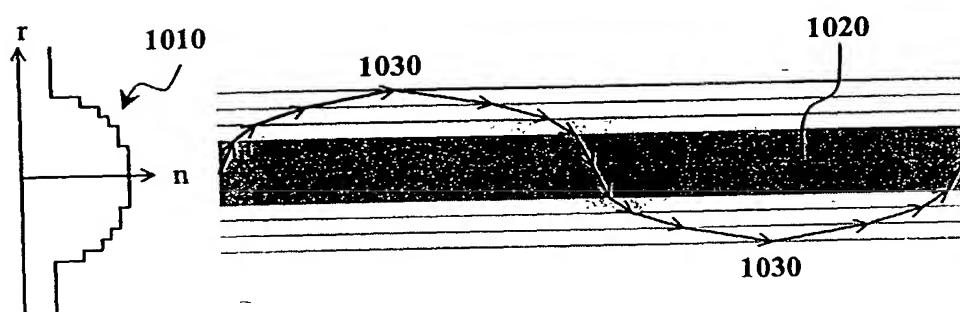


FIG 10

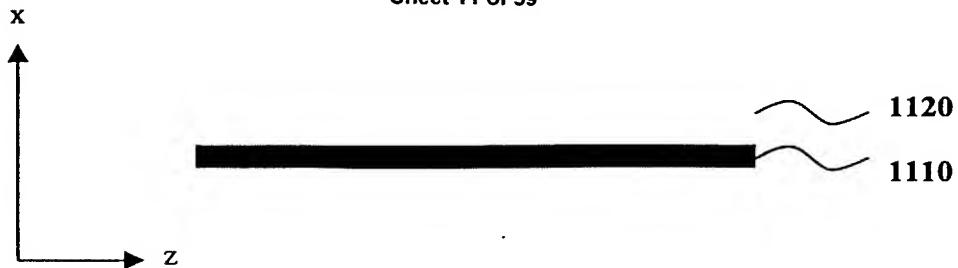


Fig 11A

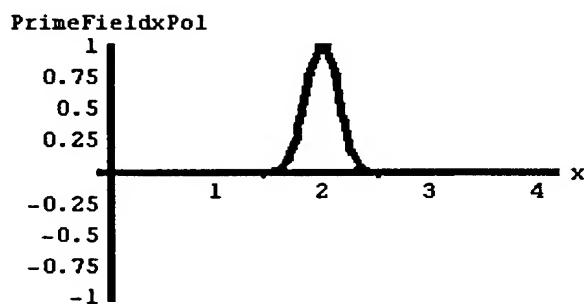


Fig 11B

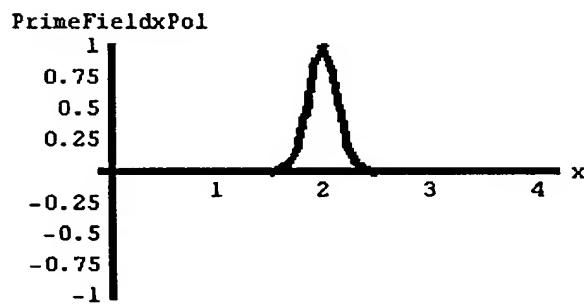


Fig 11C

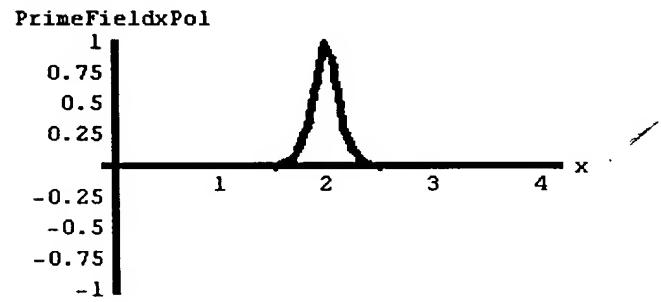


Fig 11D

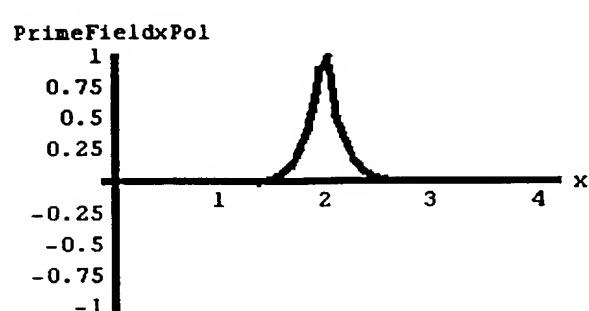


Fig 11E

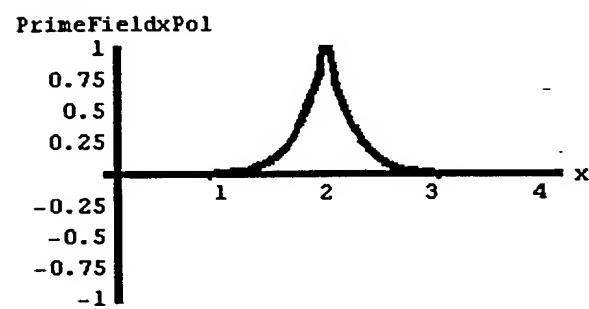


Fig 11F

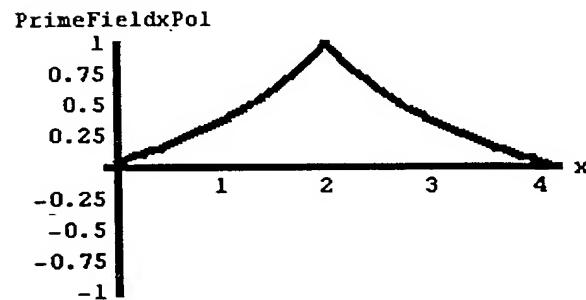
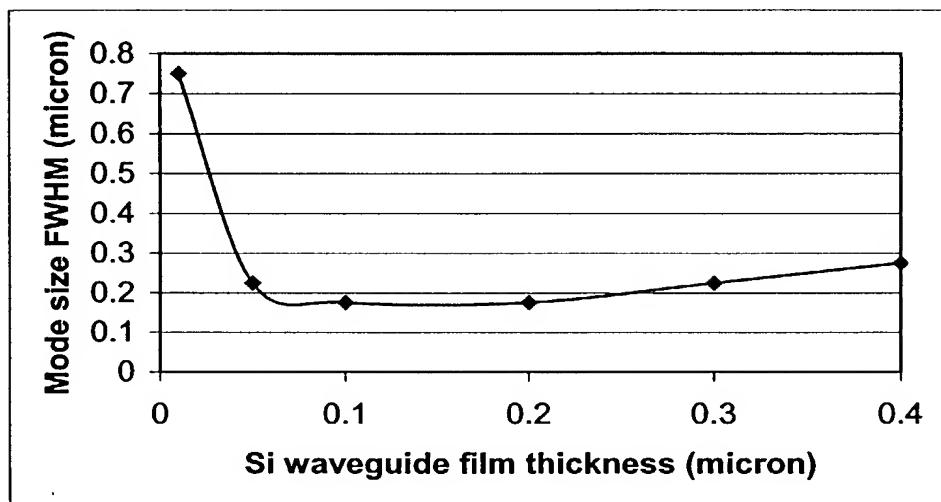


Fig 11G



**FIG. 12**

1300

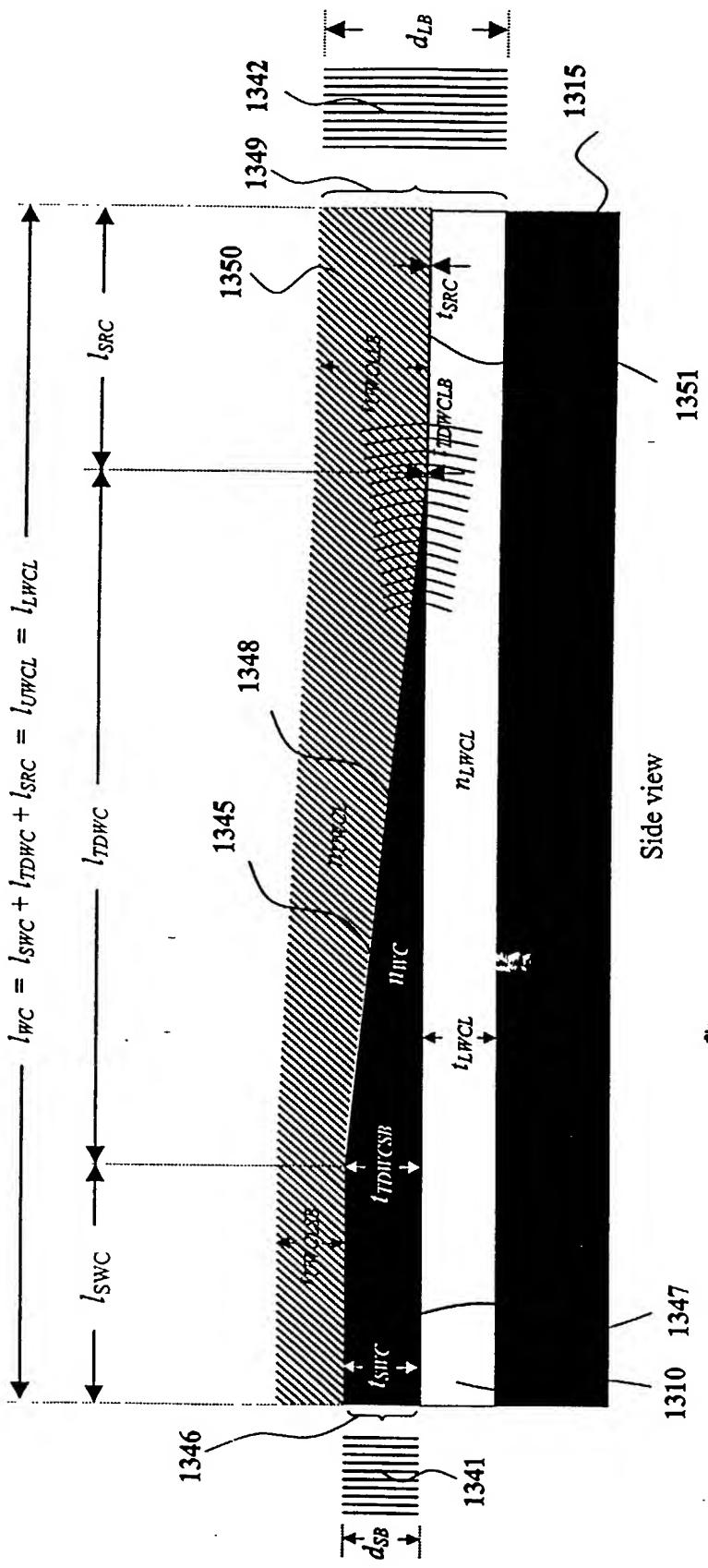


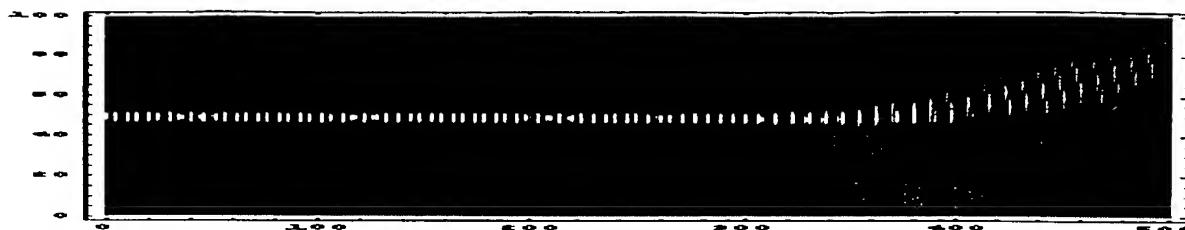
FIG 13

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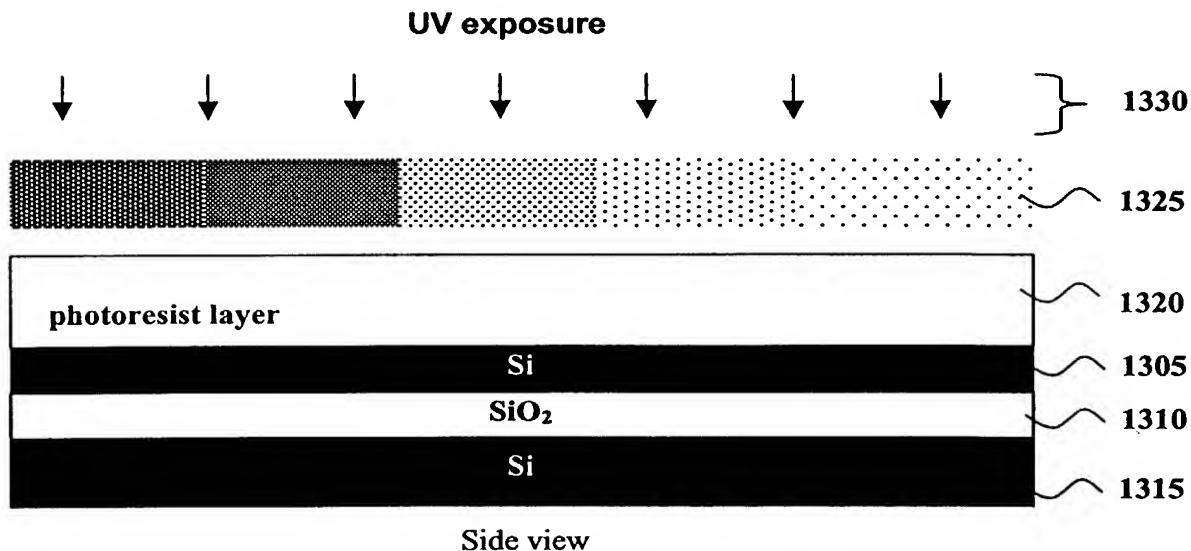
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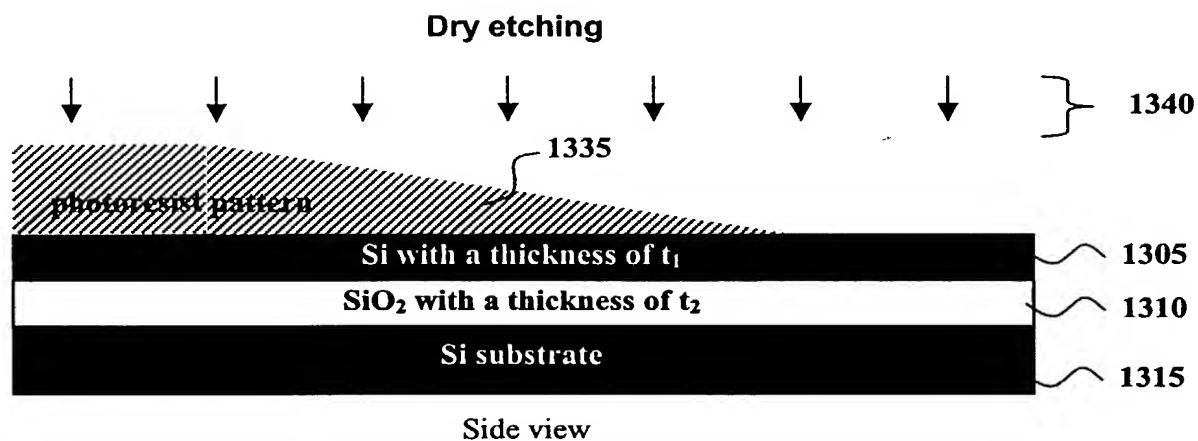
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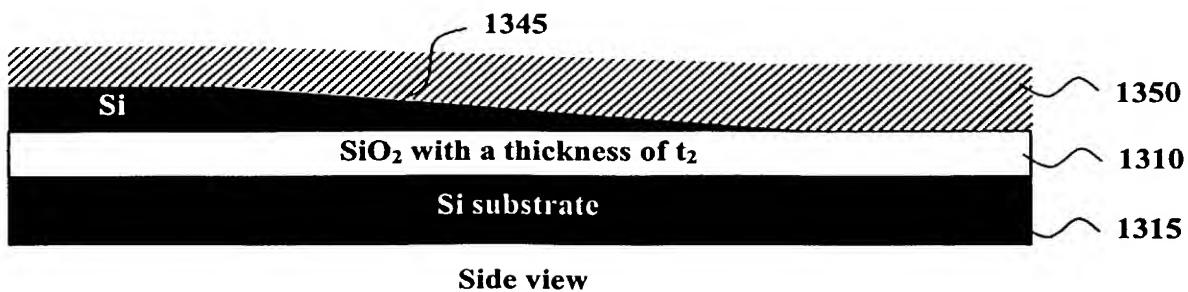
**FIG 14**



**Fig 15A**



**Fig 15B**



**Fig 15C**

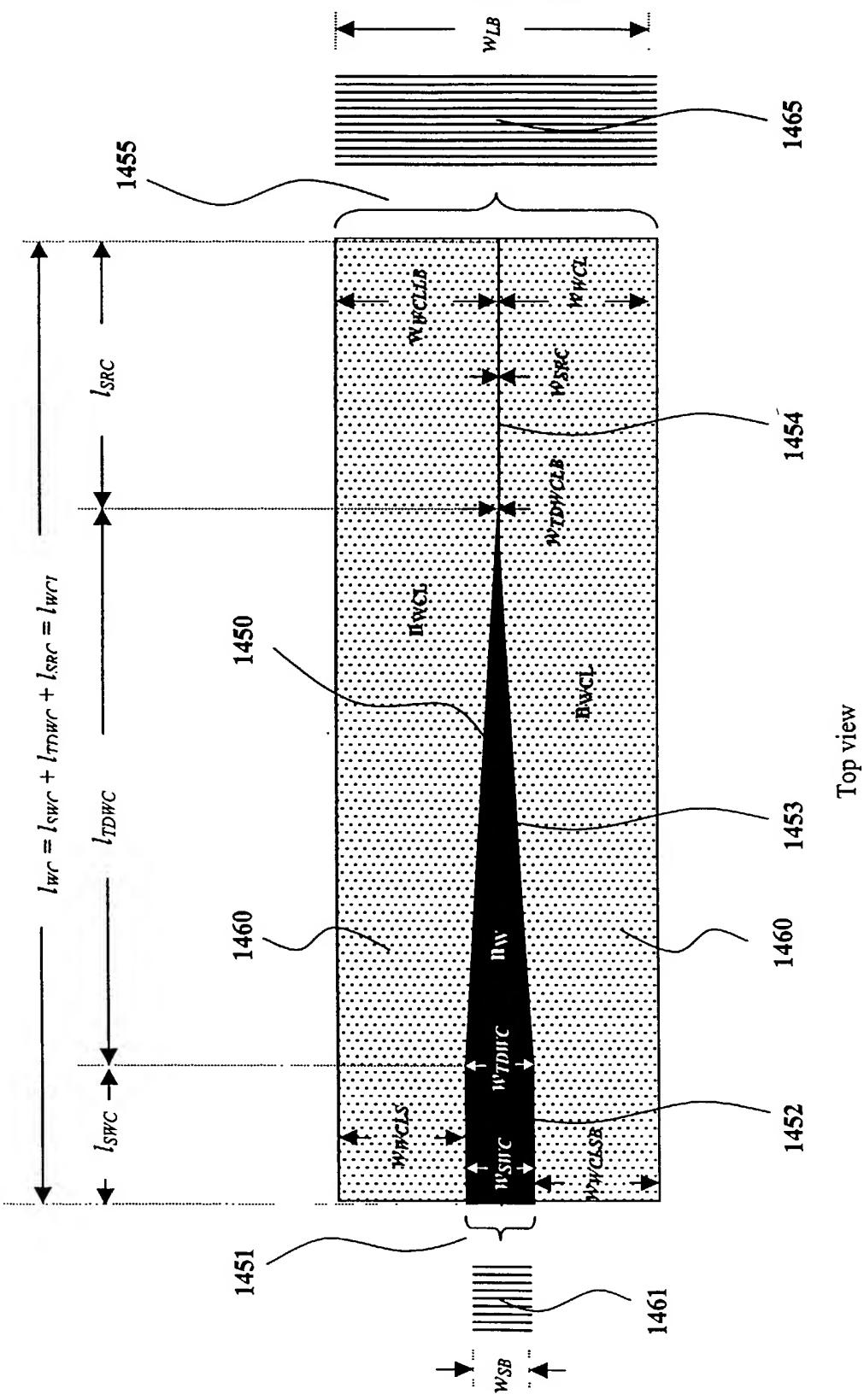


FIG. 16

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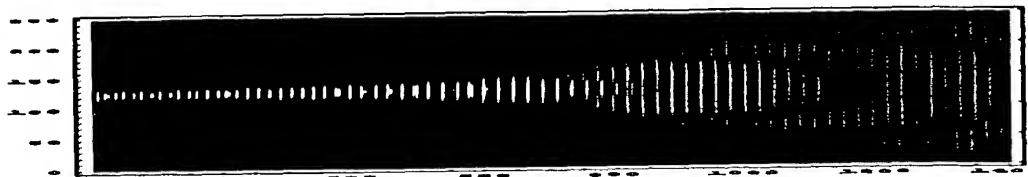


FIG 17

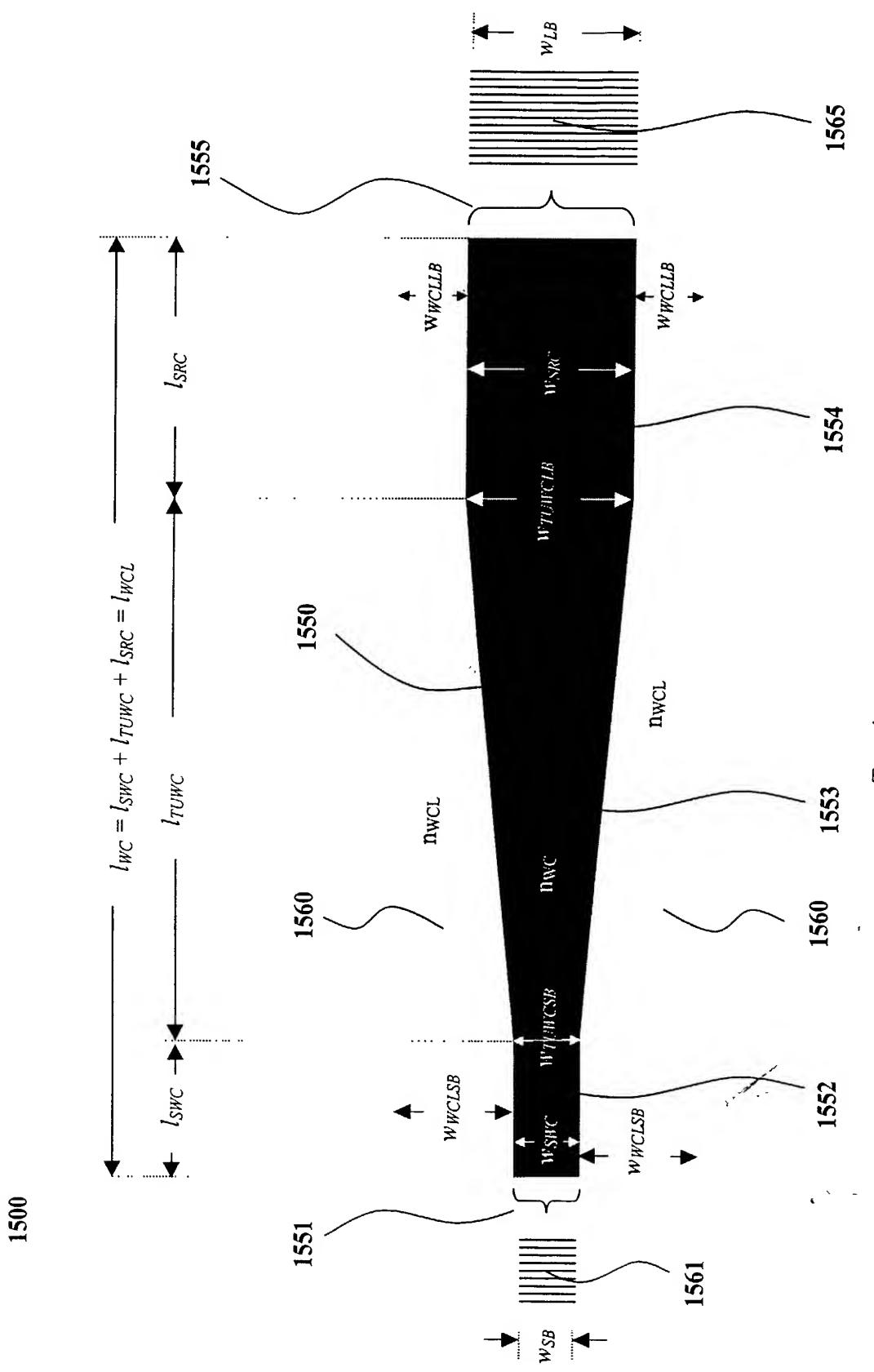
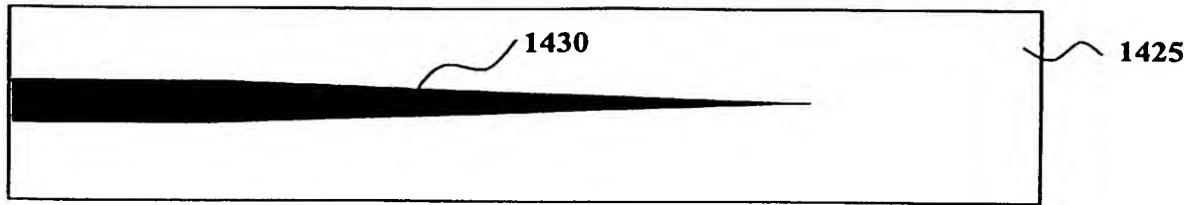
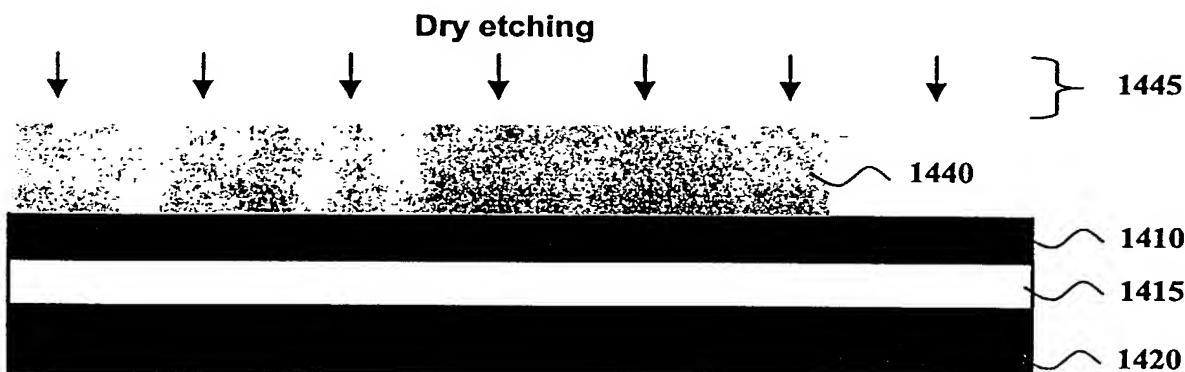


FIG. 19



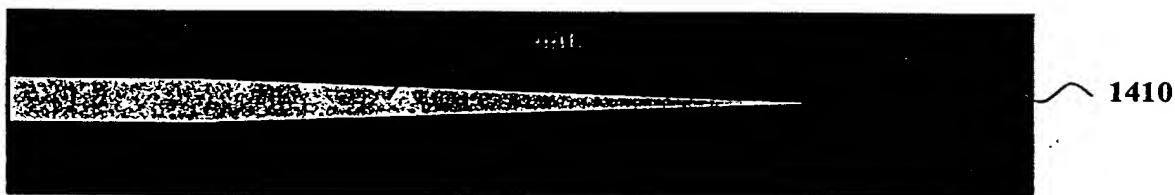
Mask top view

Fig 18A



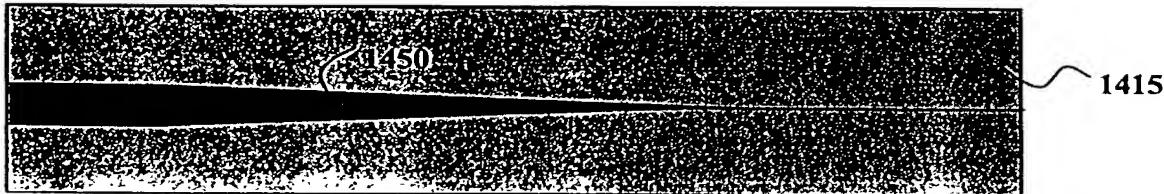
Side view

Fig 18B



Photoresist pattern top view

Fig 18C



Si tapered down/narrow section top view

Fig 18D

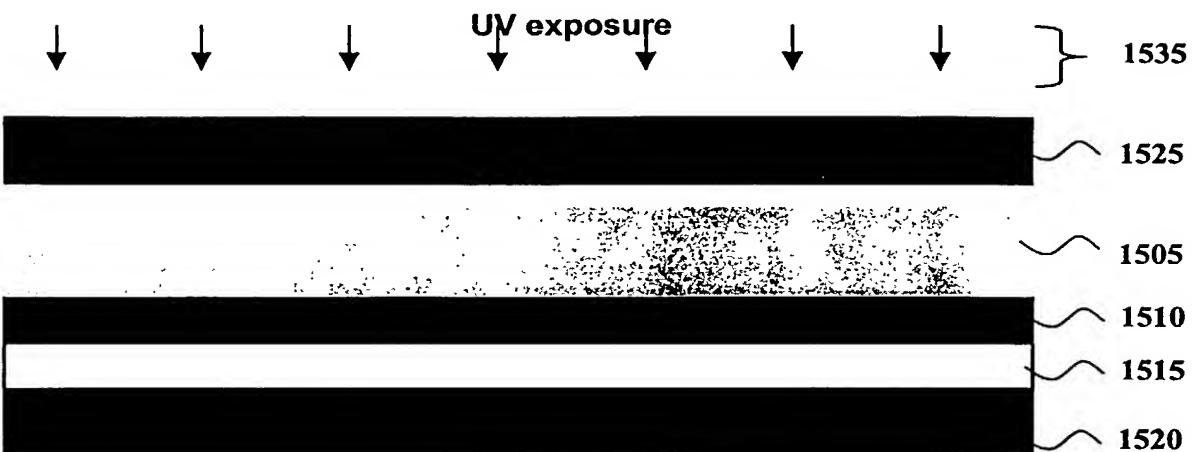
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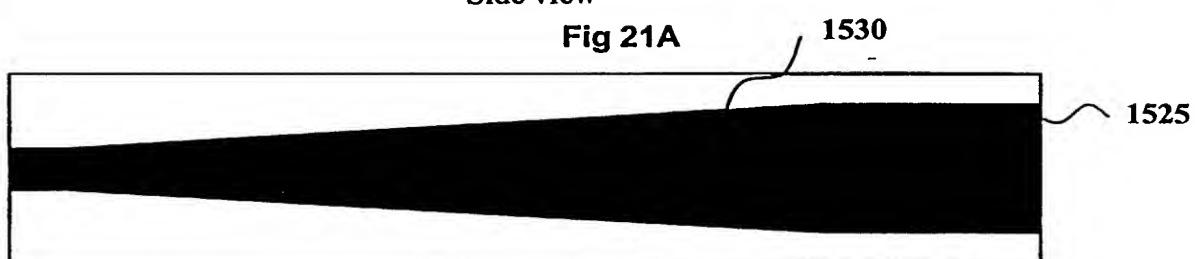


**Fig. 20**



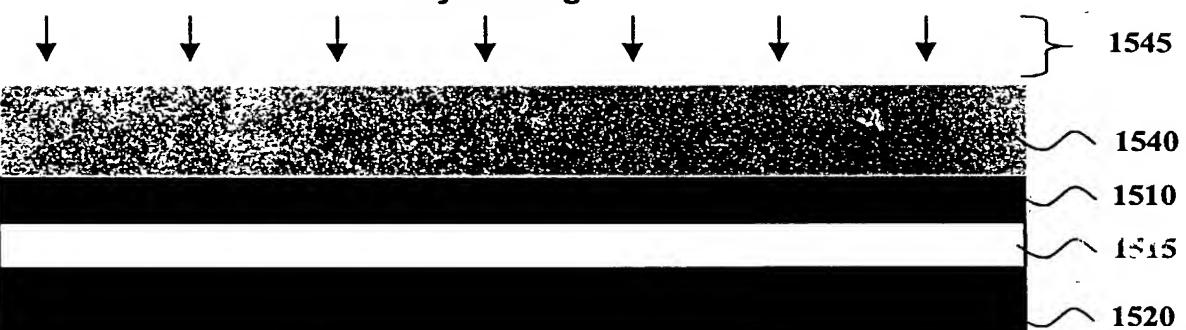
Side view

Fig 21A



Mask top view

Fig 21B  
Dry etching



Side view

Fig 21C  
1540



Photoresist pattern top view Fig 21D

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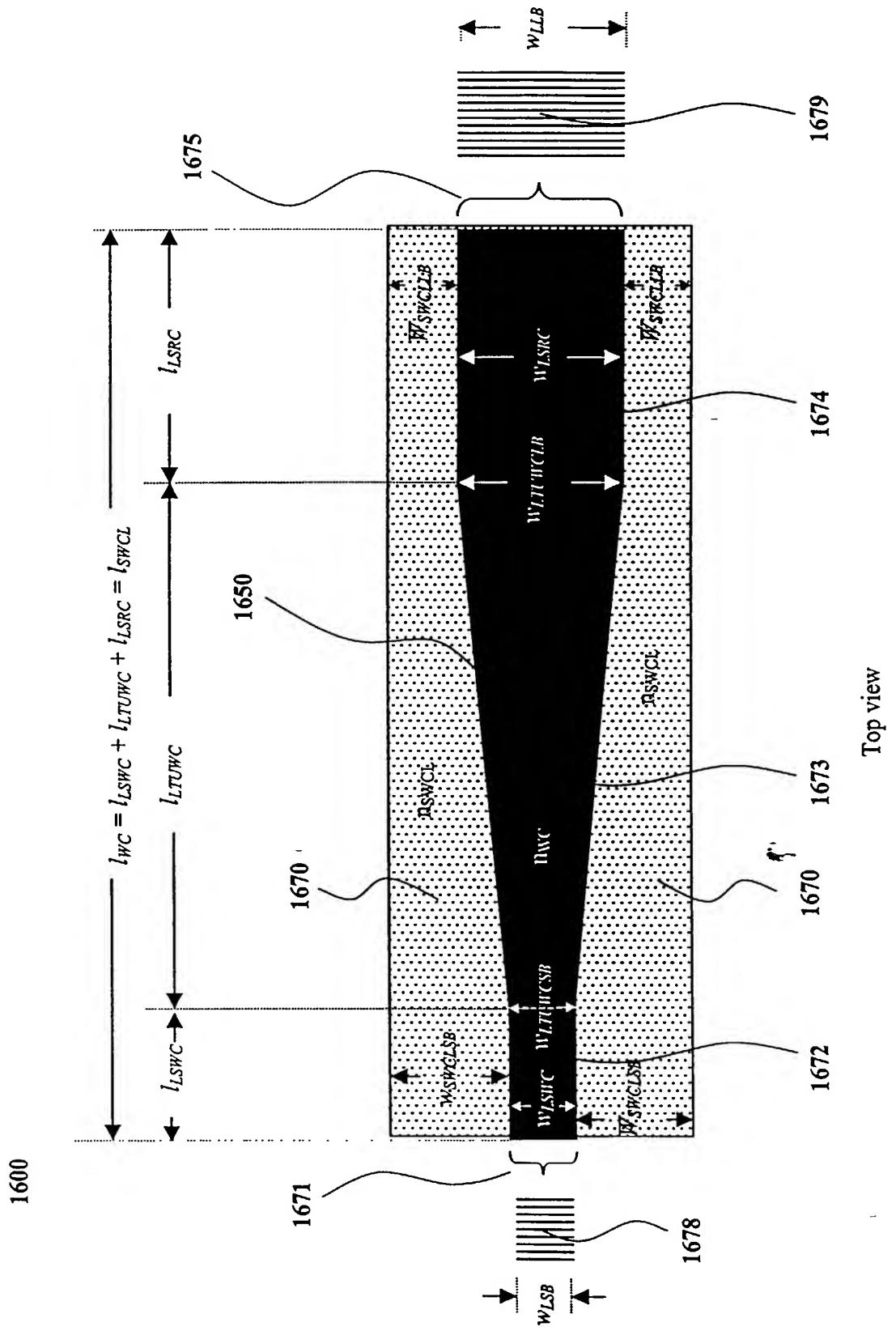
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1550



Si tapered up/wide section top view

**FIG. 21E**



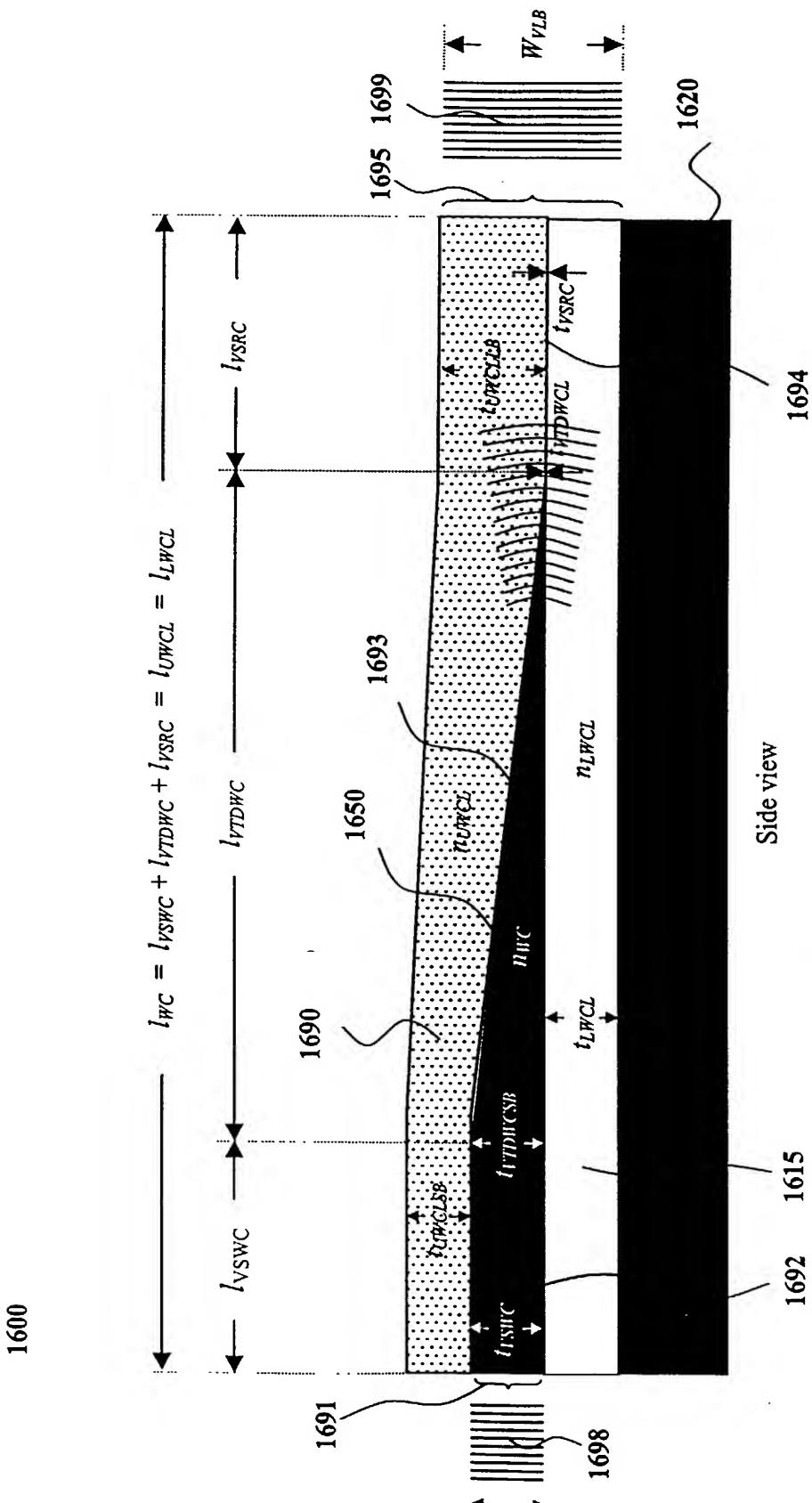
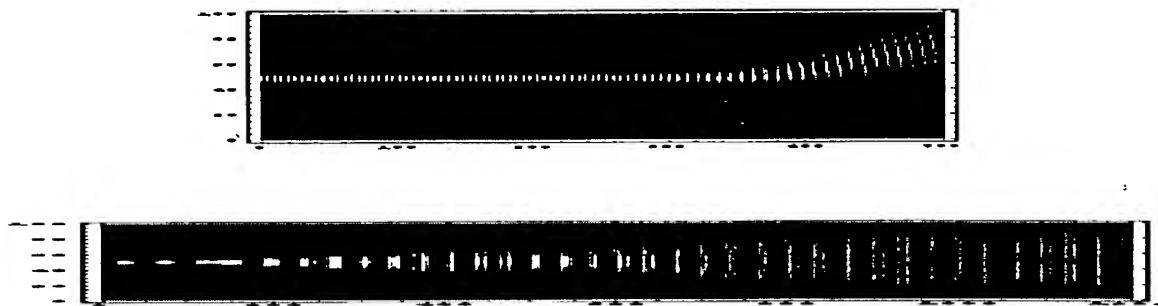


FIG 22B

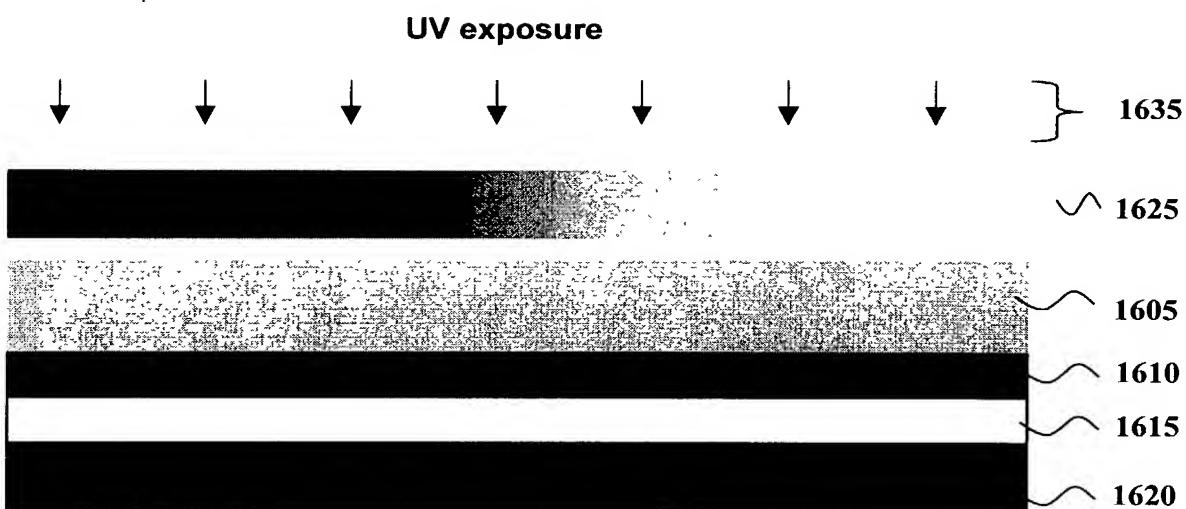
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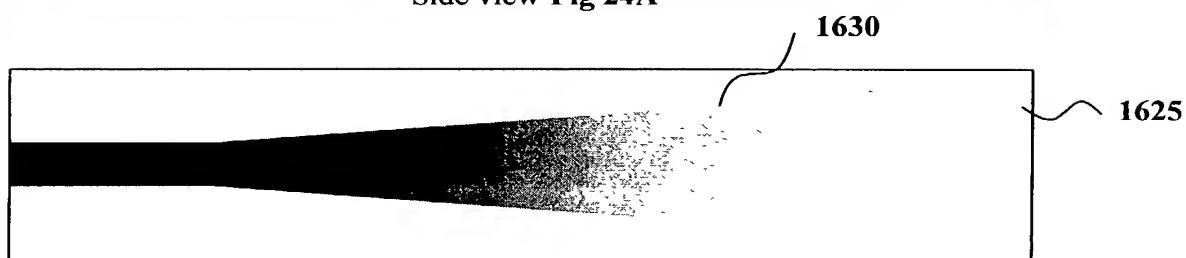
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**FIG 23**

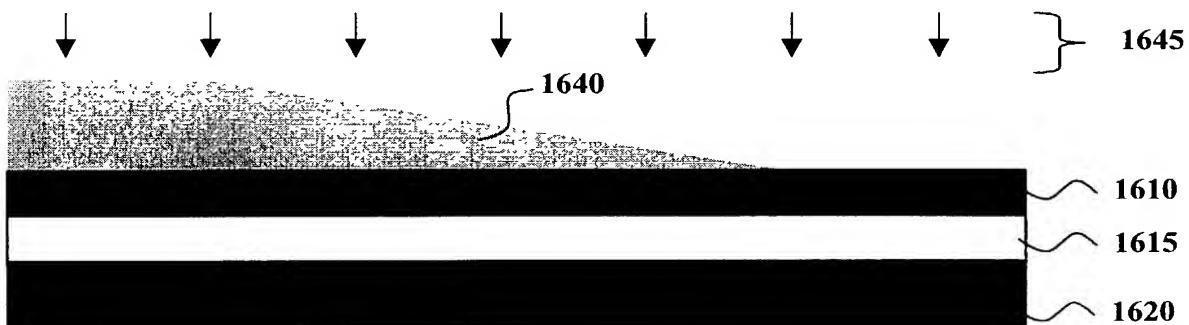


Side view-Fig 24A

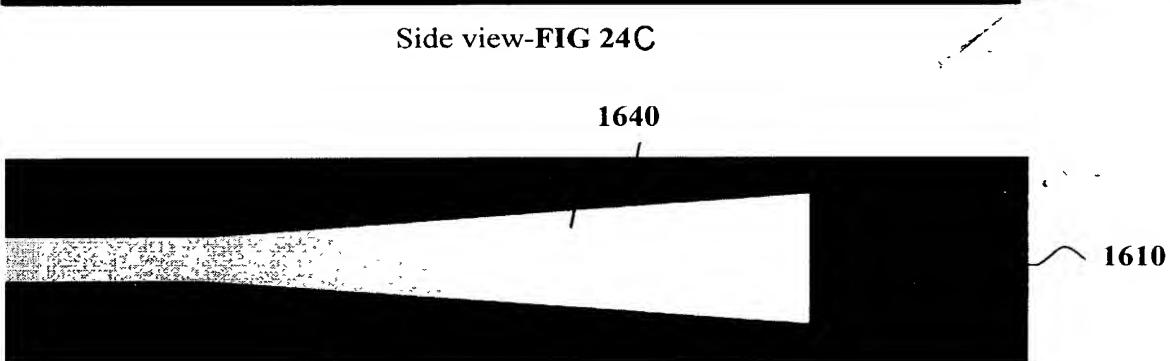


Mask top view-Fig 24B

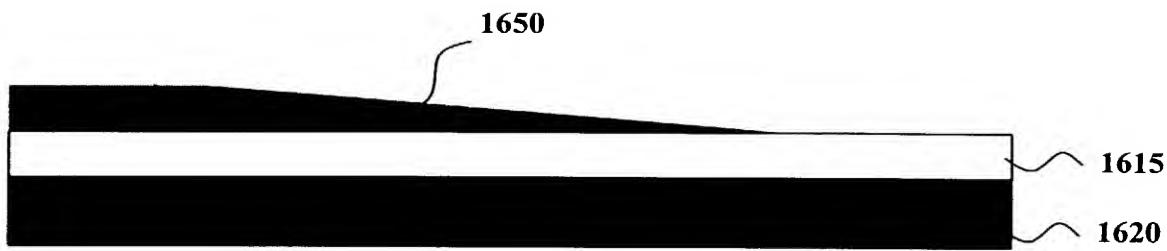
Dry etching



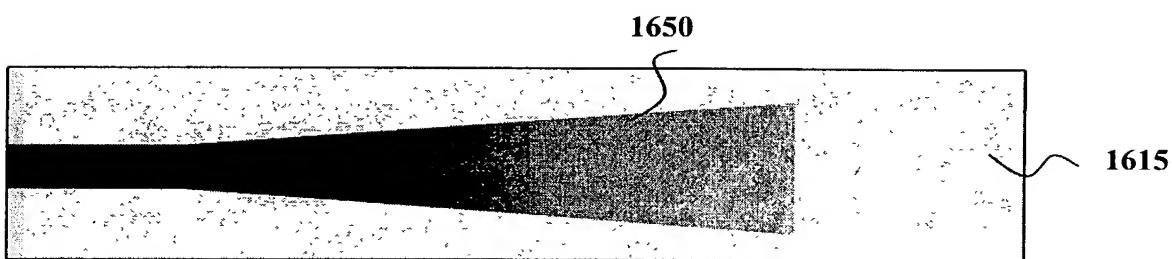
Side view-FIG 24C



Photoresist pattern top view-FIG24D



Side view-FIG24E



Si tapered up/wide section top view

FIG. 24F

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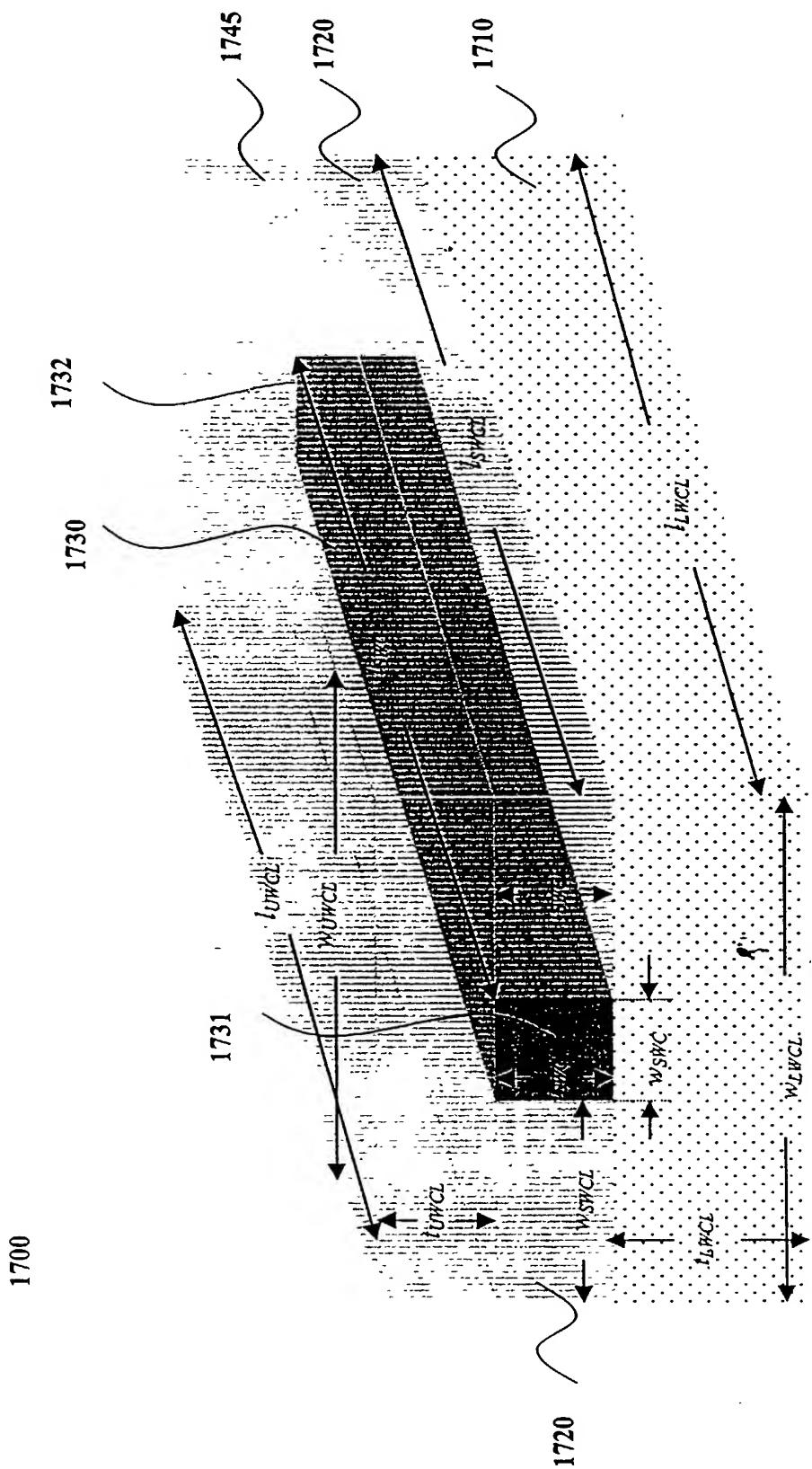
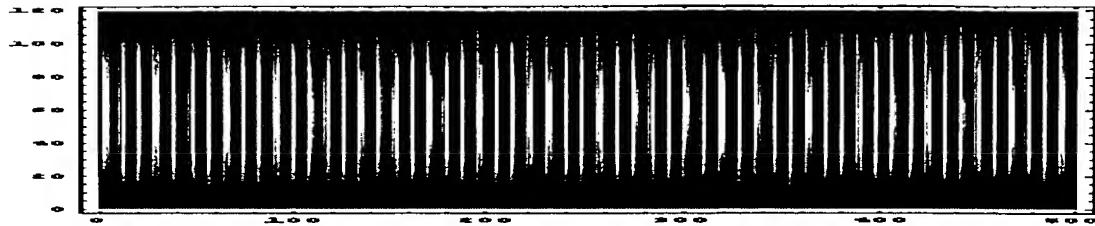
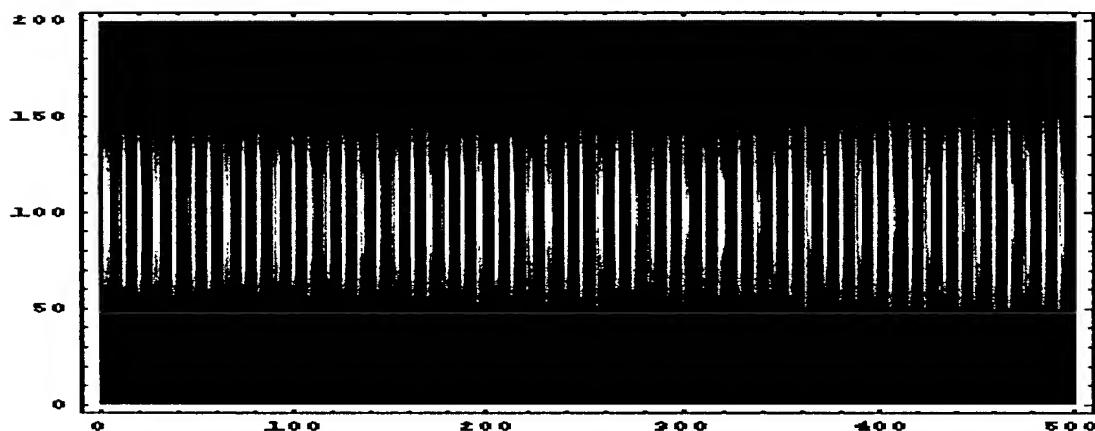


FIG 25

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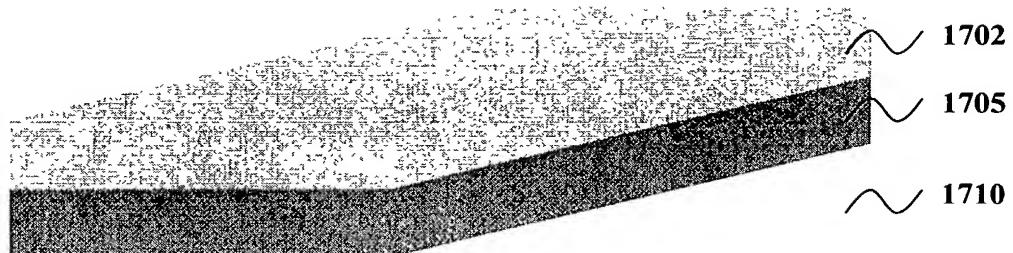
side view



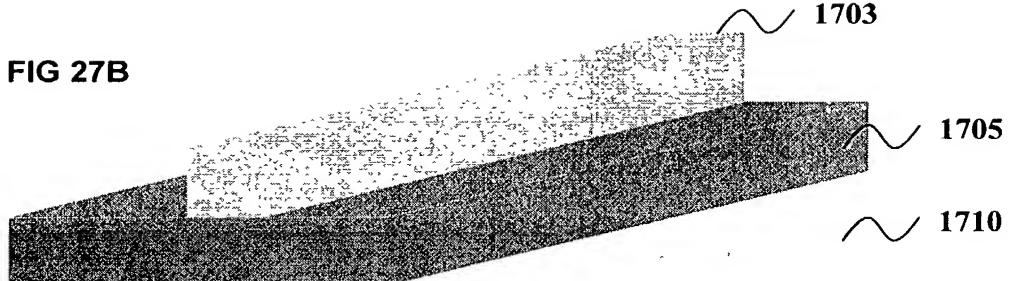
top view

**FIG 26**

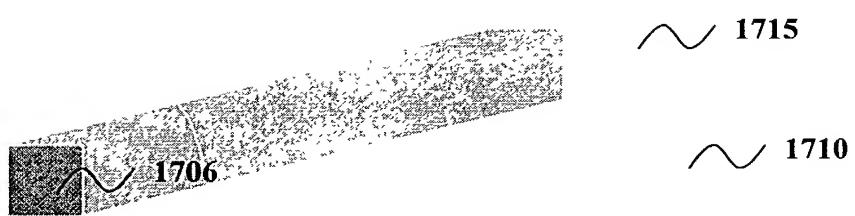
**FIG 27A**



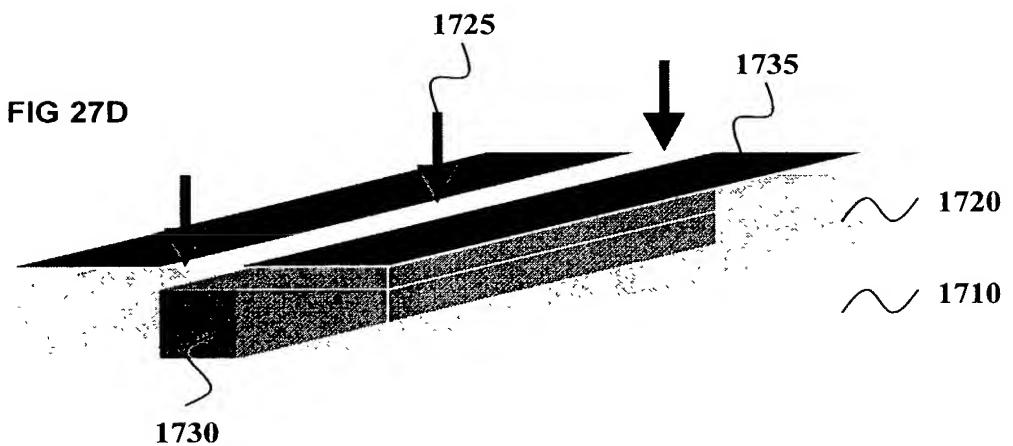
**FIG 27B**



**FIG 27C**



**FIG 27D**



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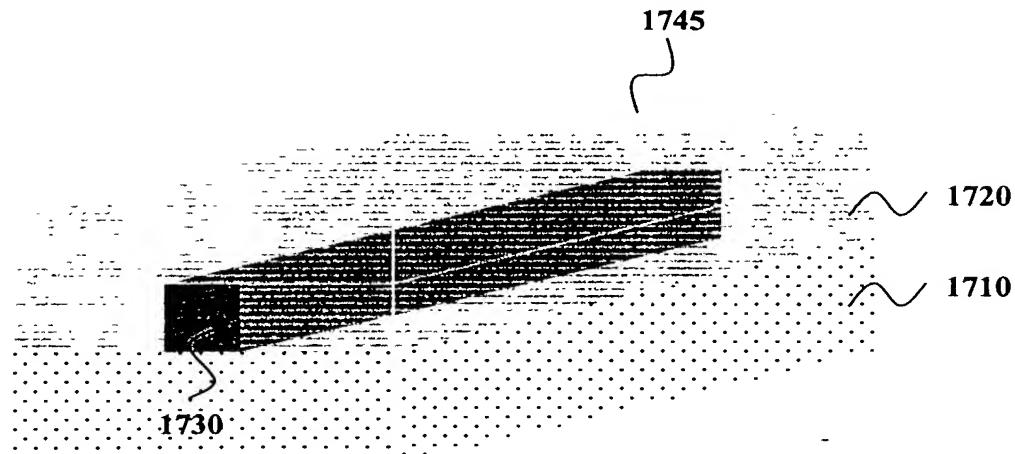


FIG. 27E

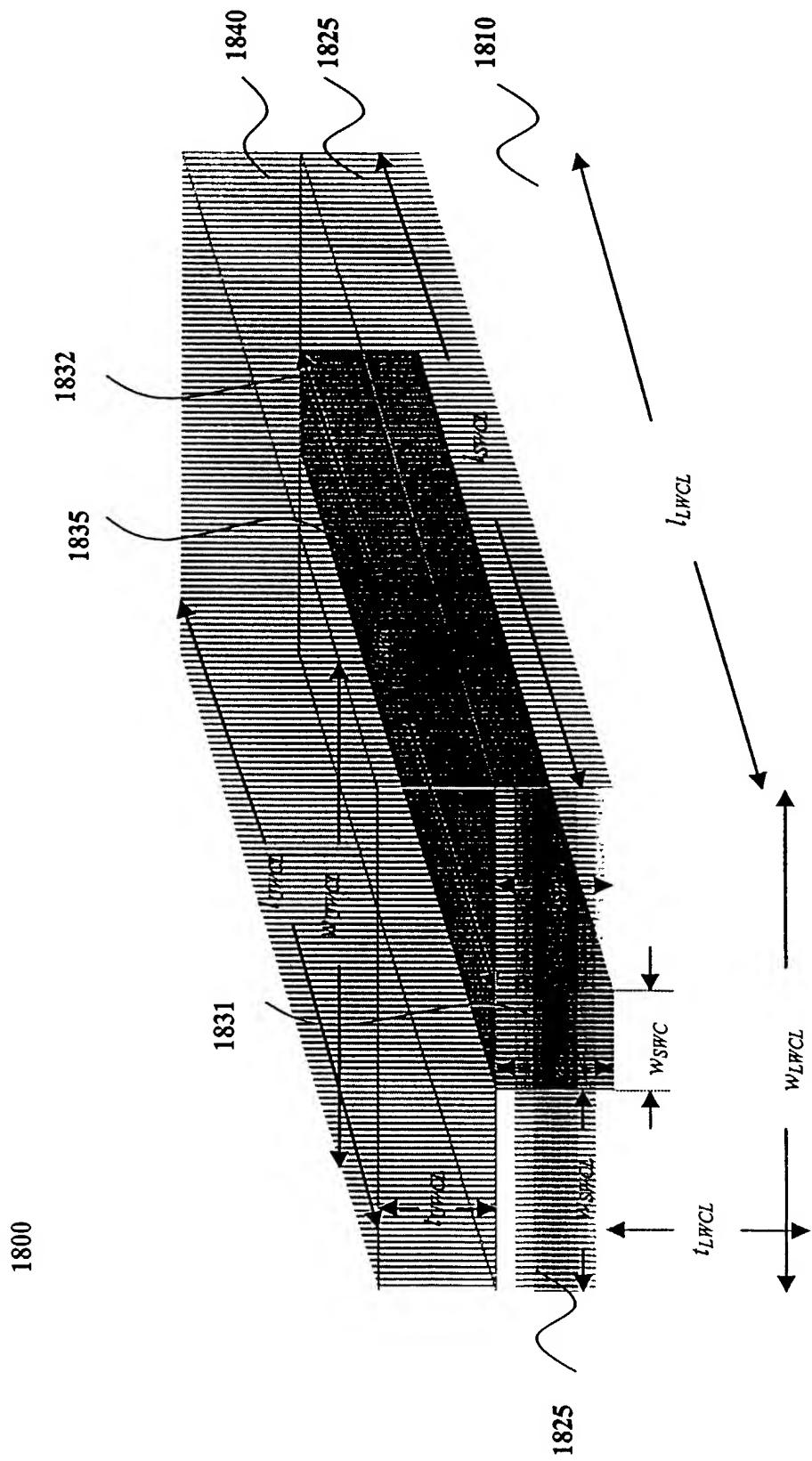
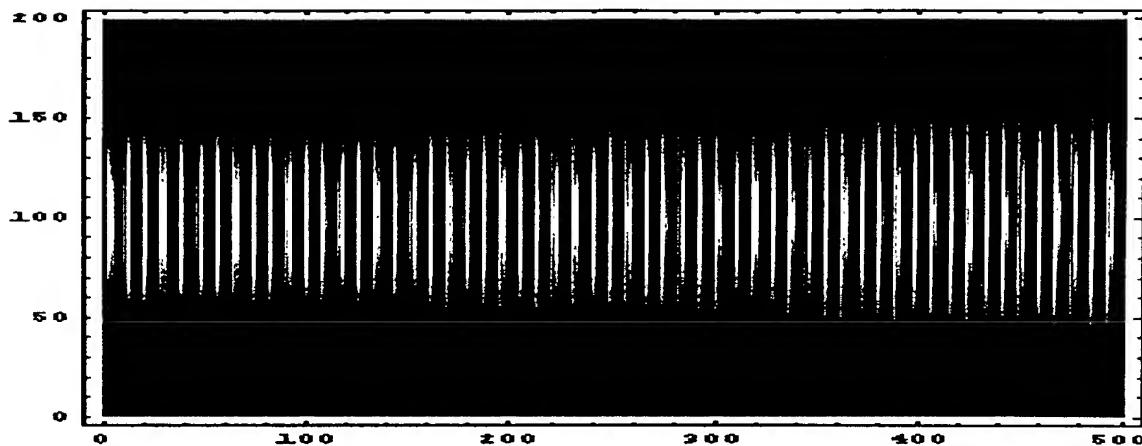
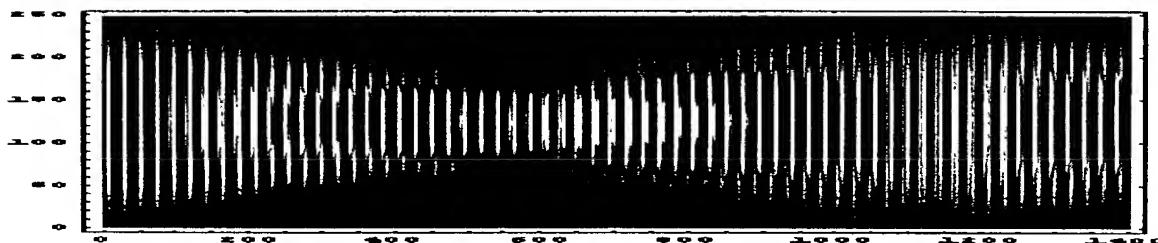


FIG 28



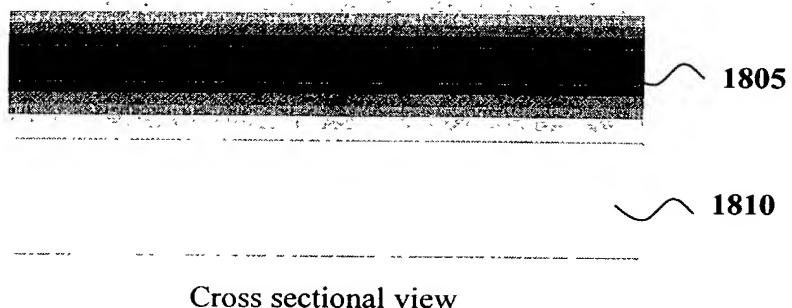
top view



side view

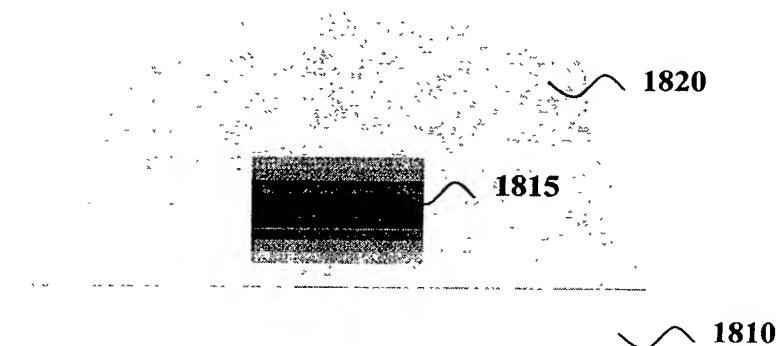
Fig 29

**FIG 30A**



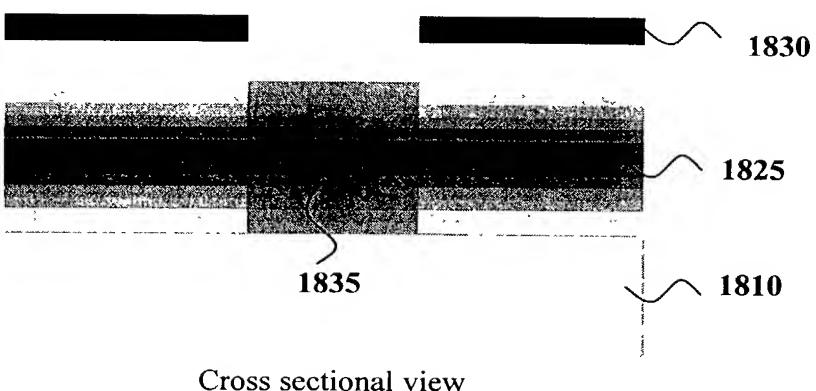
Cross sectional view

**FIG 30B**



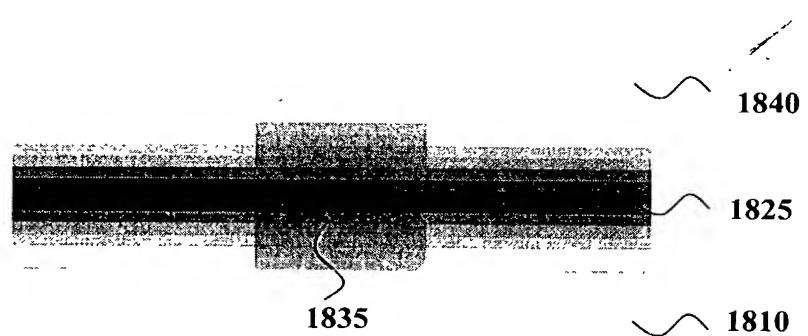
Cross sectional view

**FIG 30C**



Cross sectional view

**FIG 30D**



Cross sectional view

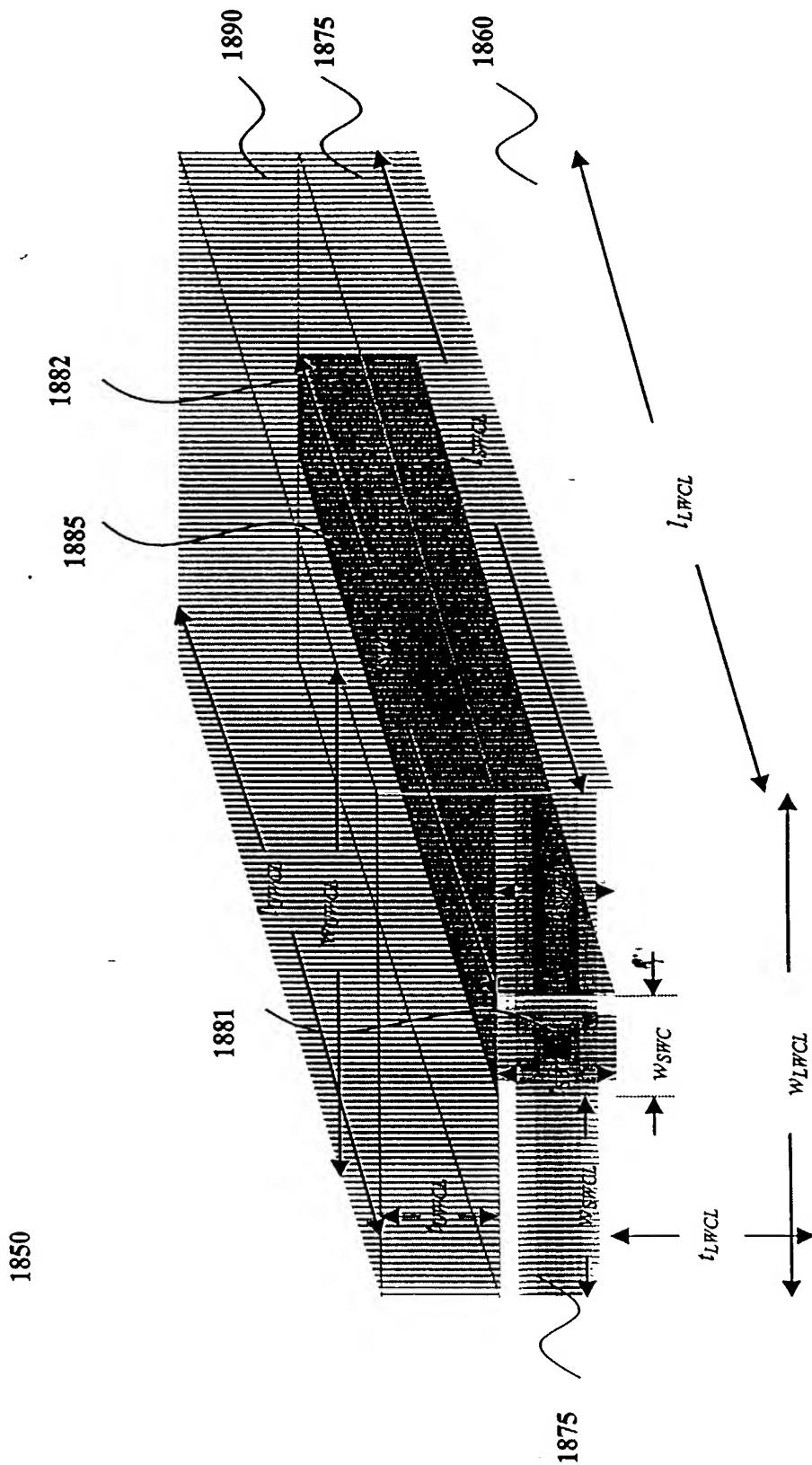
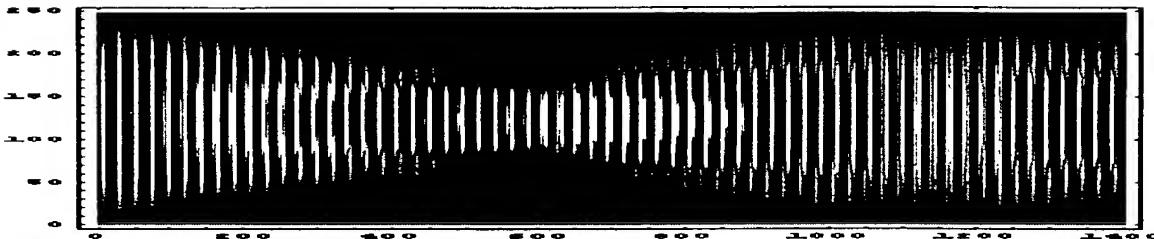
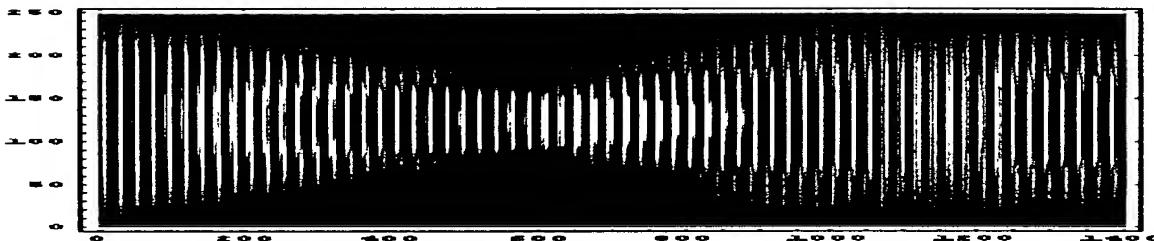


FIG 31

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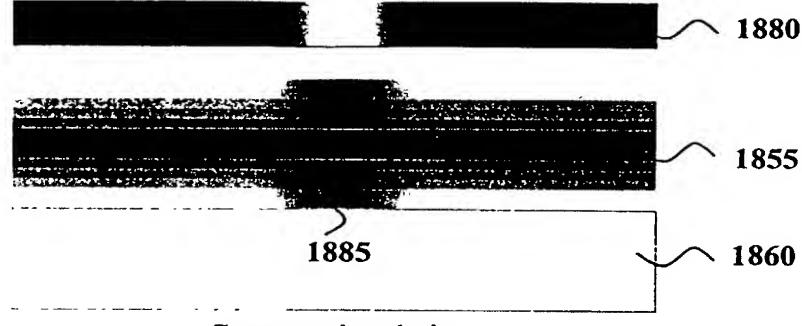
top view



side view

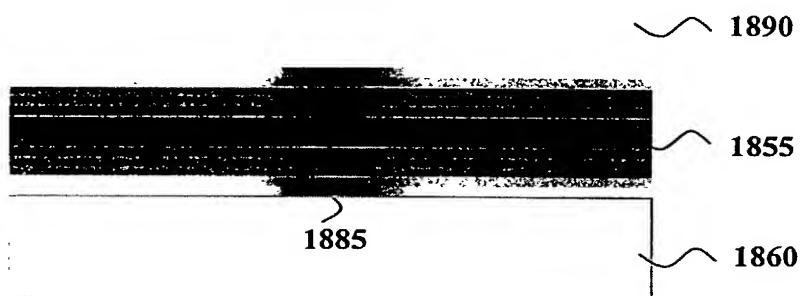
Fig 32

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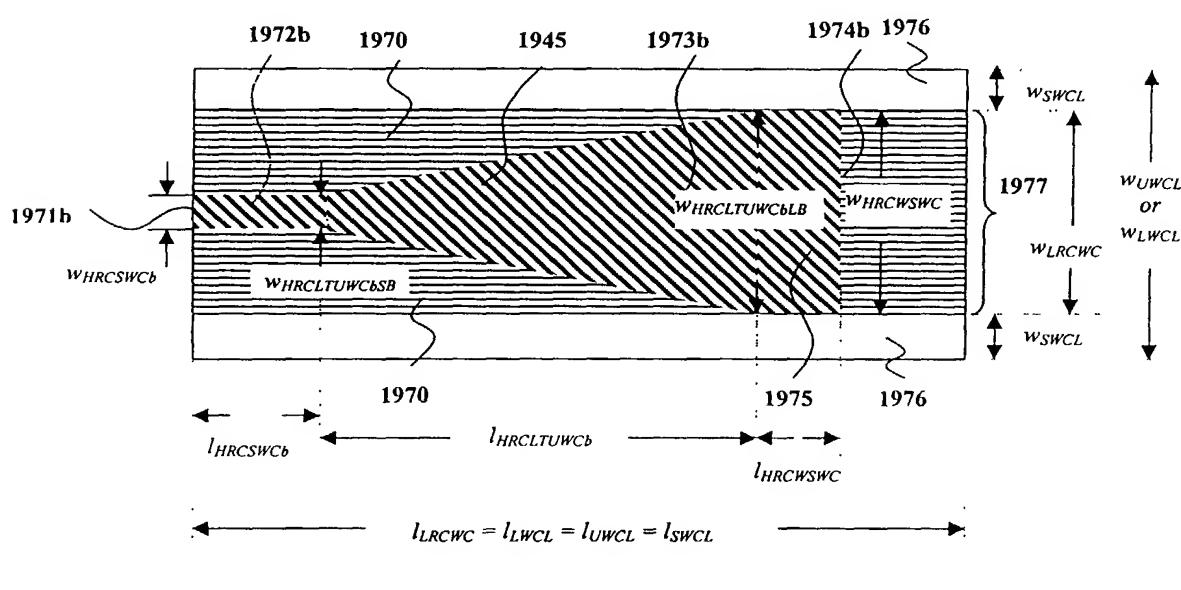
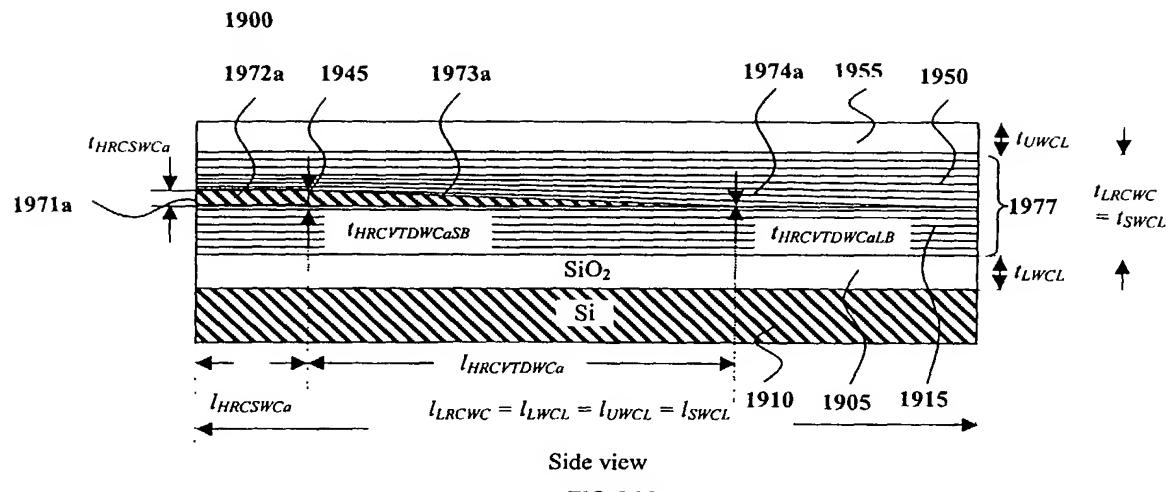
Cross sectional view

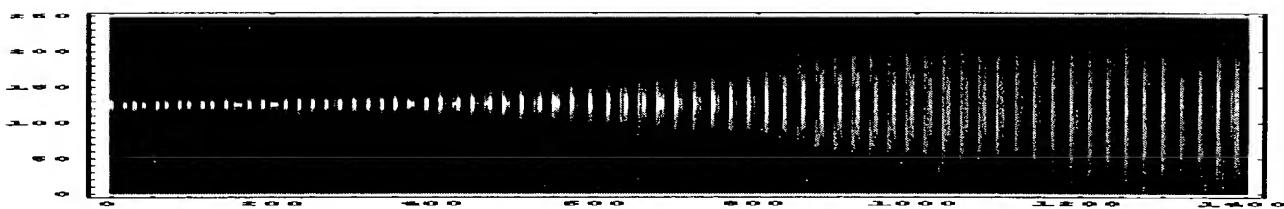
**FIG 33A**



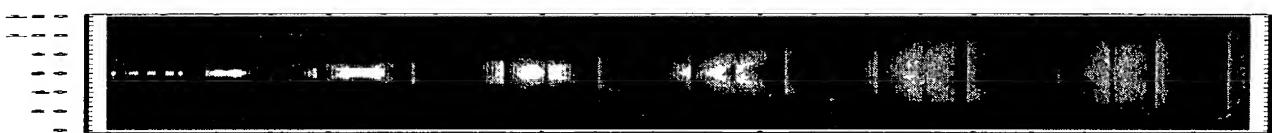
Cross sectional view

**FIG. 33B**





### **Side view**



### Top view

**FIG 35**

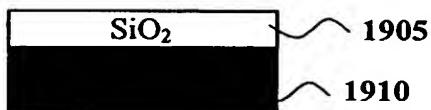


FIG 36A

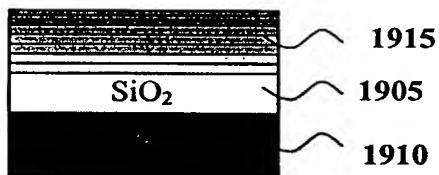


FIG 36B

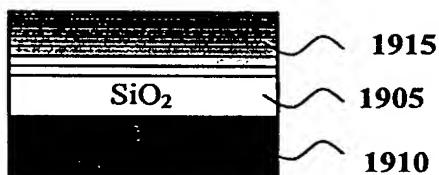


FIG 36C

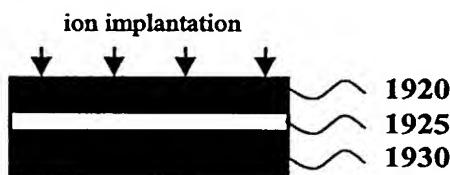


FIG 36D

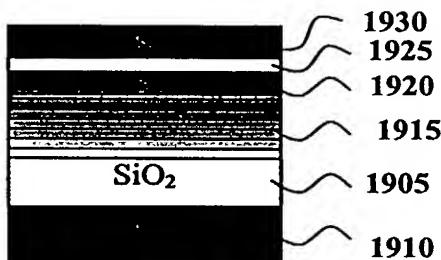


FIG 36E

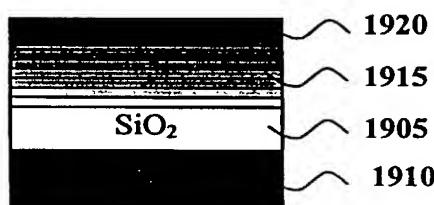
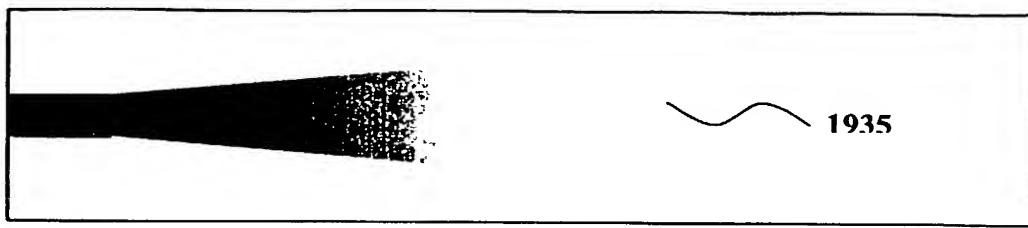
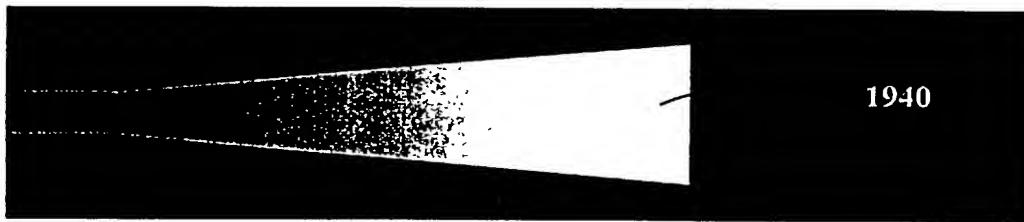


FIG 36F

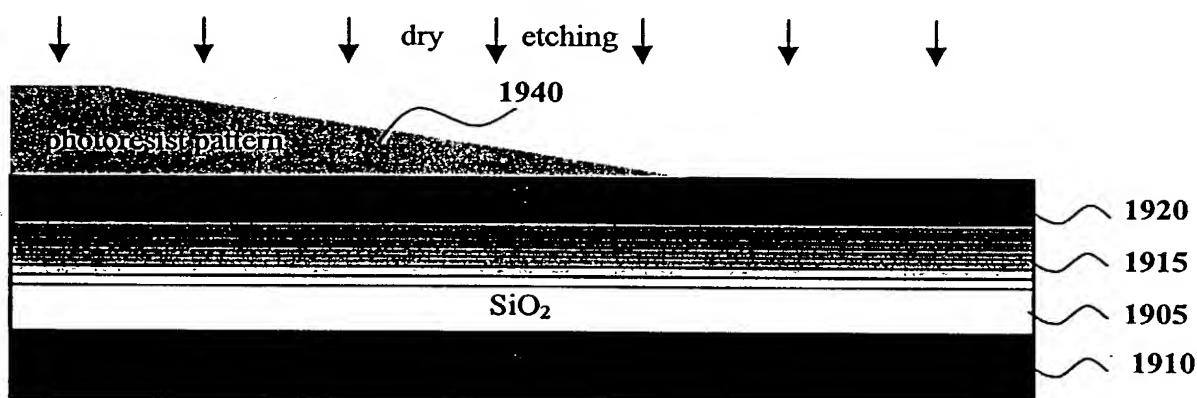


Mask top view  
**FIG 36G**



photoresist pattern top view

**FIG 36H**

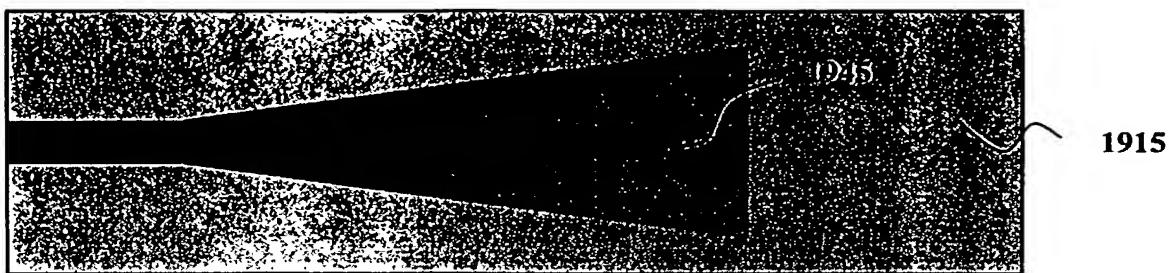


Side view  
**FIG 36I**

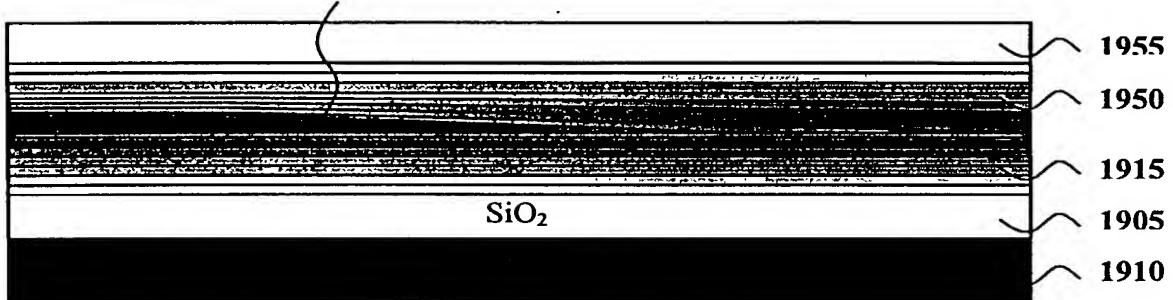
1945



Side view  
**FIG 36J**



Top view  
1945 FIG 36K



Side view  
FIG 36L



mask  
FIG 36M 1945 1965



Top view  
FIG. 36N

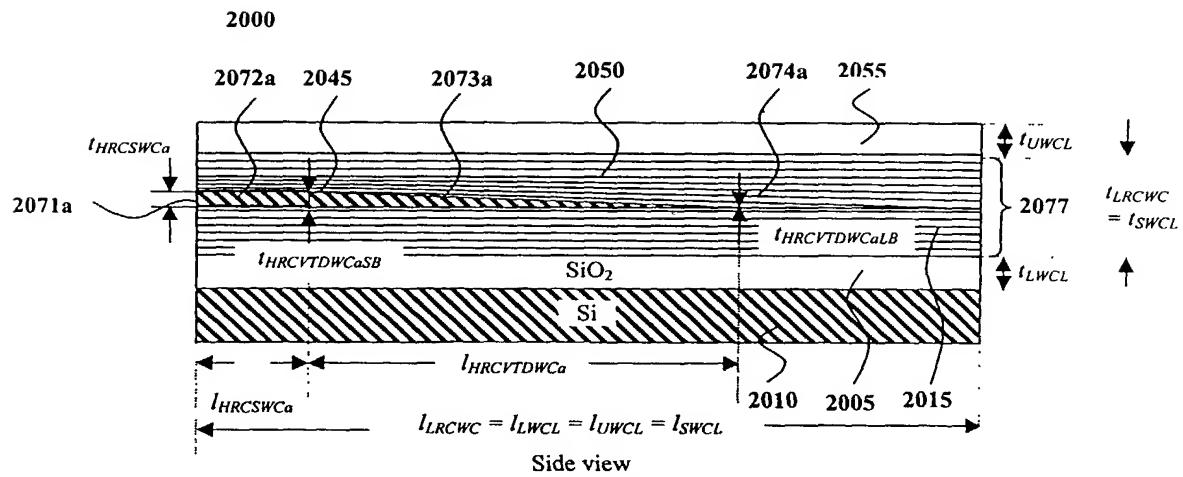


FIG 37A

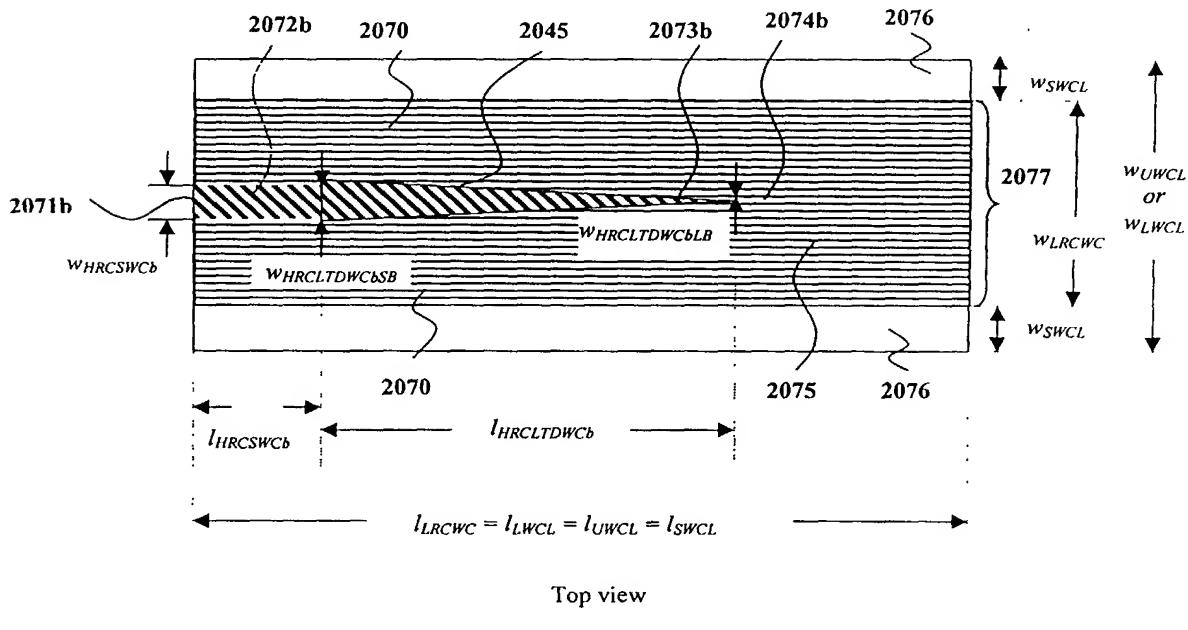


FIG 37B

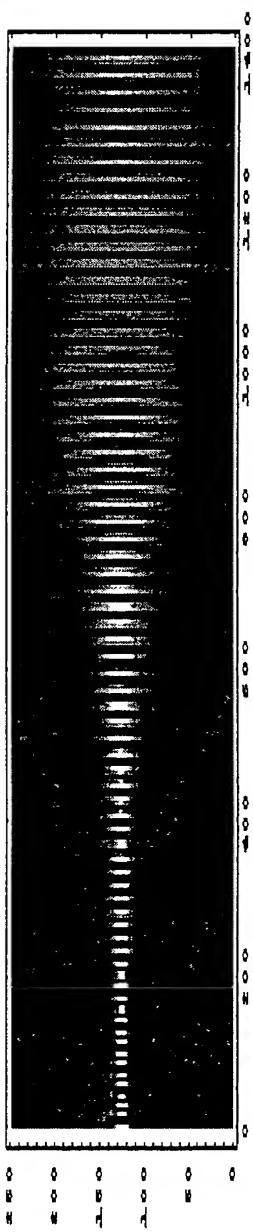


FIG 38

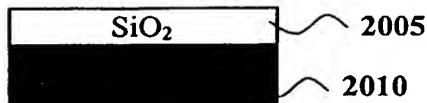


FIG 39A

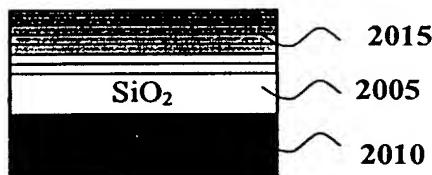


FIG 39B

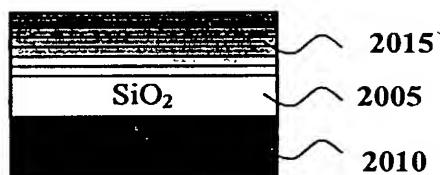


FIG 39C

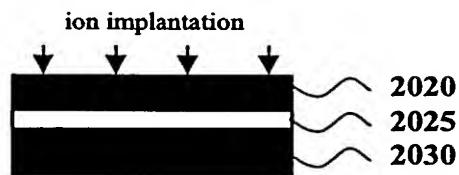


FIG 39D

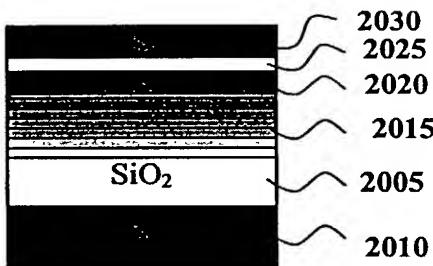


FIG 39E

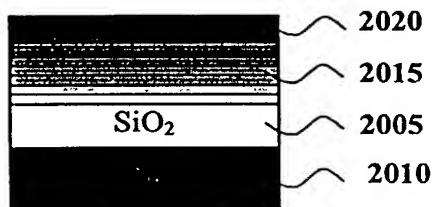
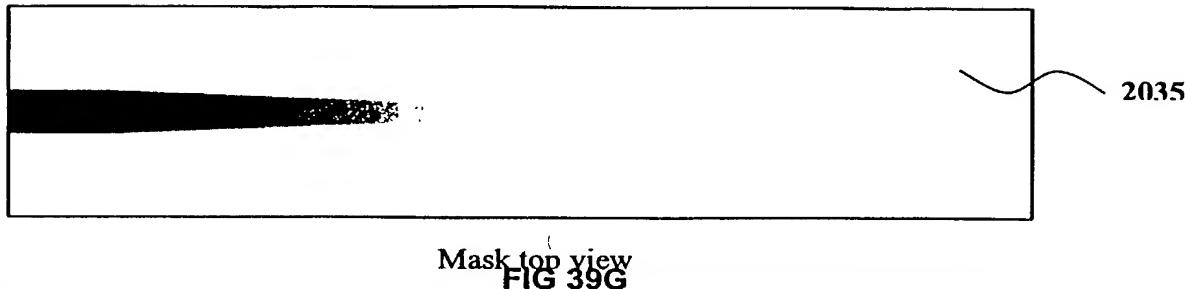


FIG 39F

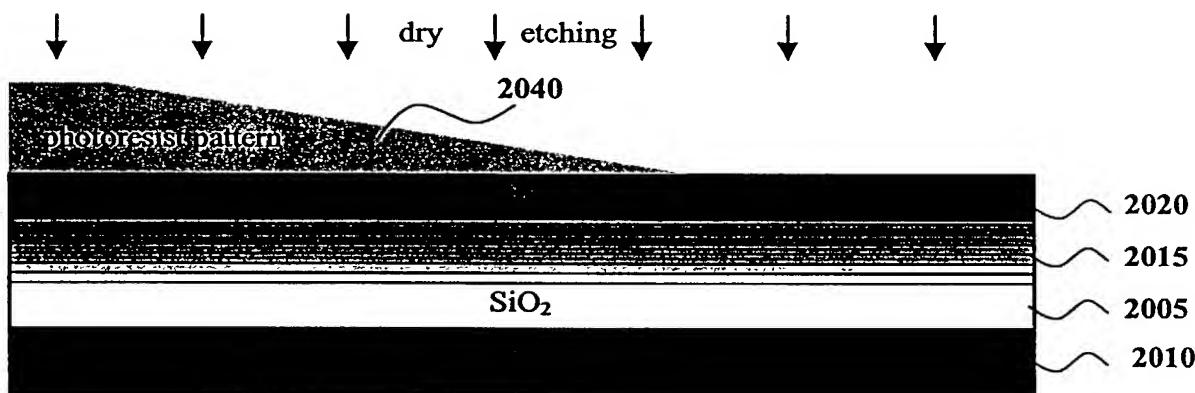


Mask top view  
**FIG 39G**

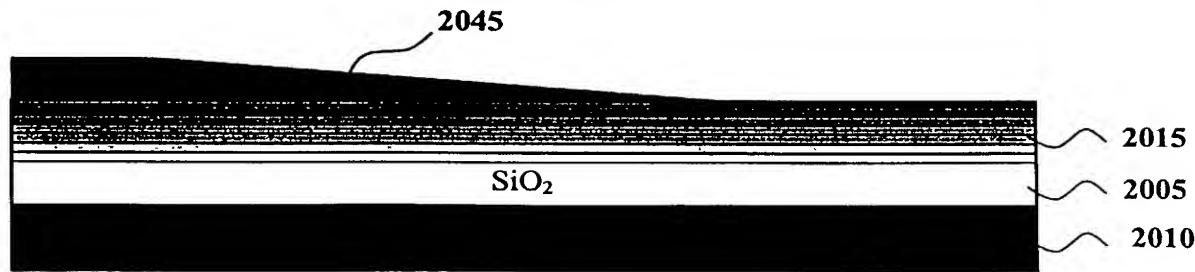


photoresist pattern top view

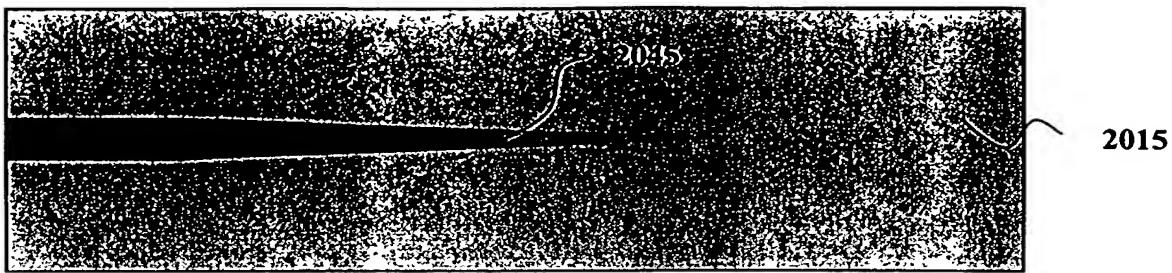
**FIG 39H**



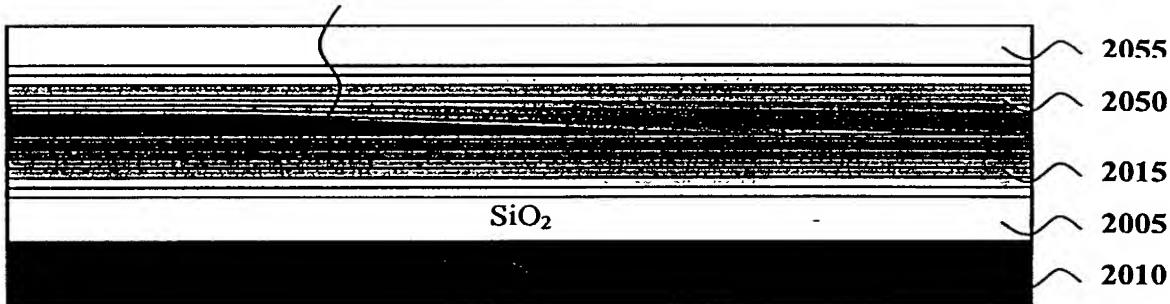
Side view  
**FIG 39I**



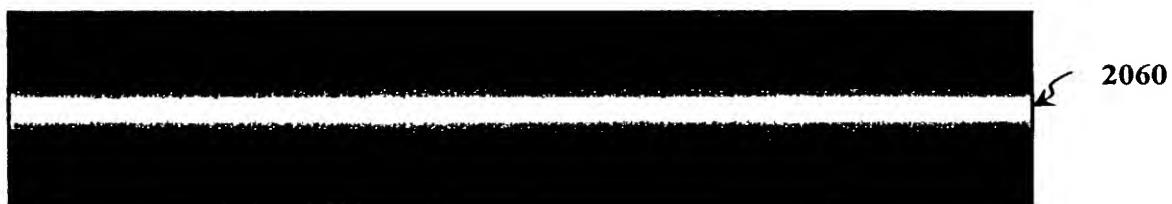
Side view  
**FIG 39J**



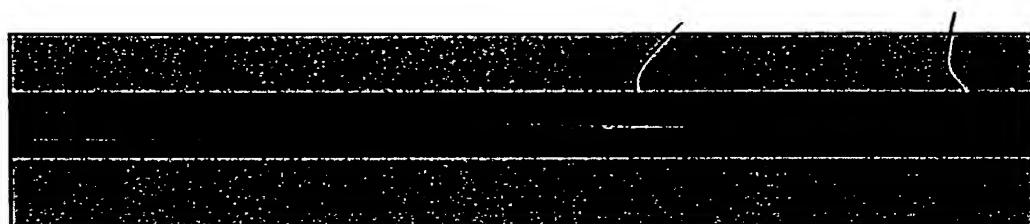
2045 Top view  
**FIG 39K**



Side view  
**FIG 39L**



mask  
**FIG 39M** 2045 2065



Top view  
**FIG. 39N**

2100

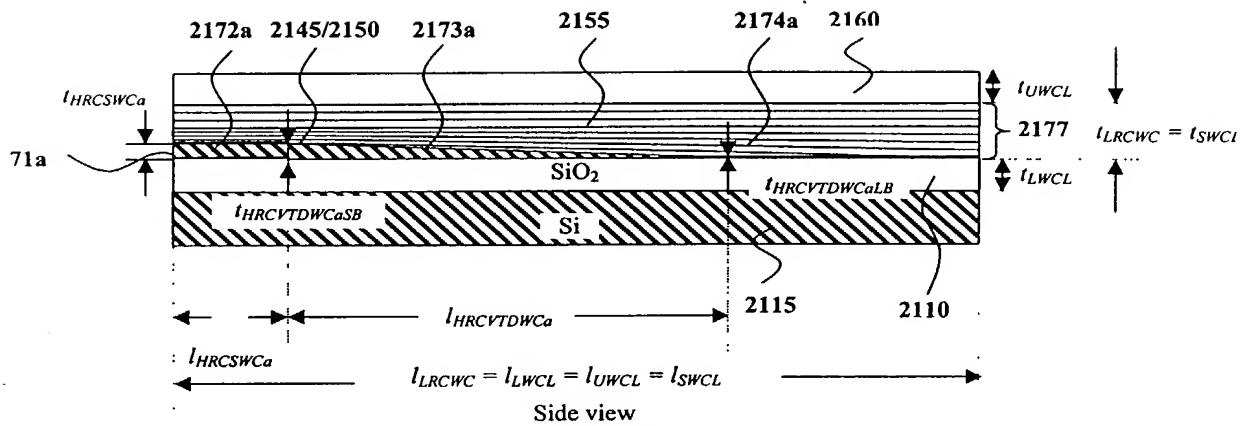
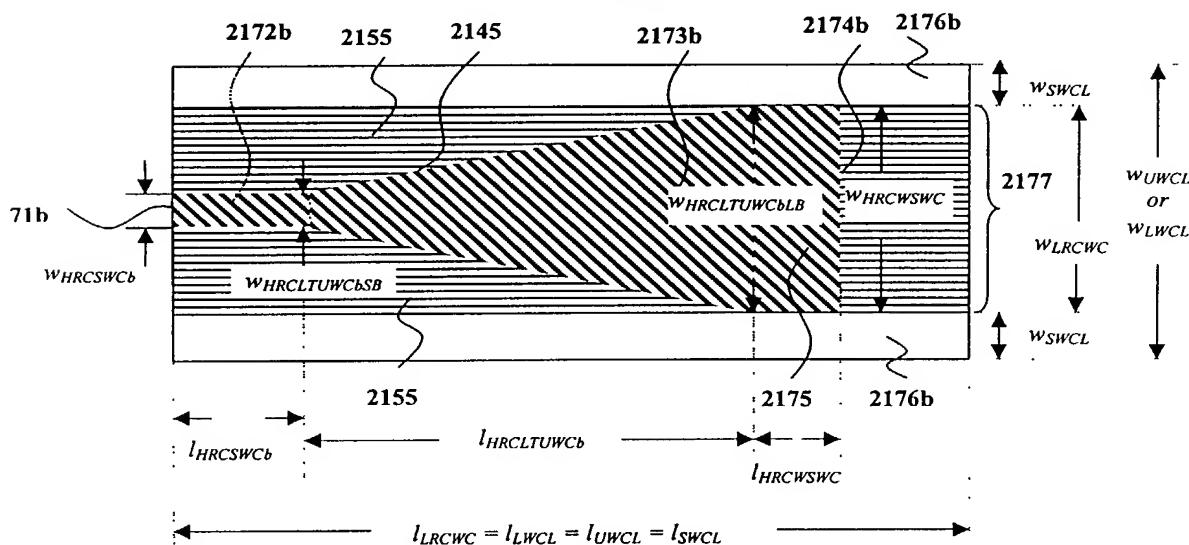
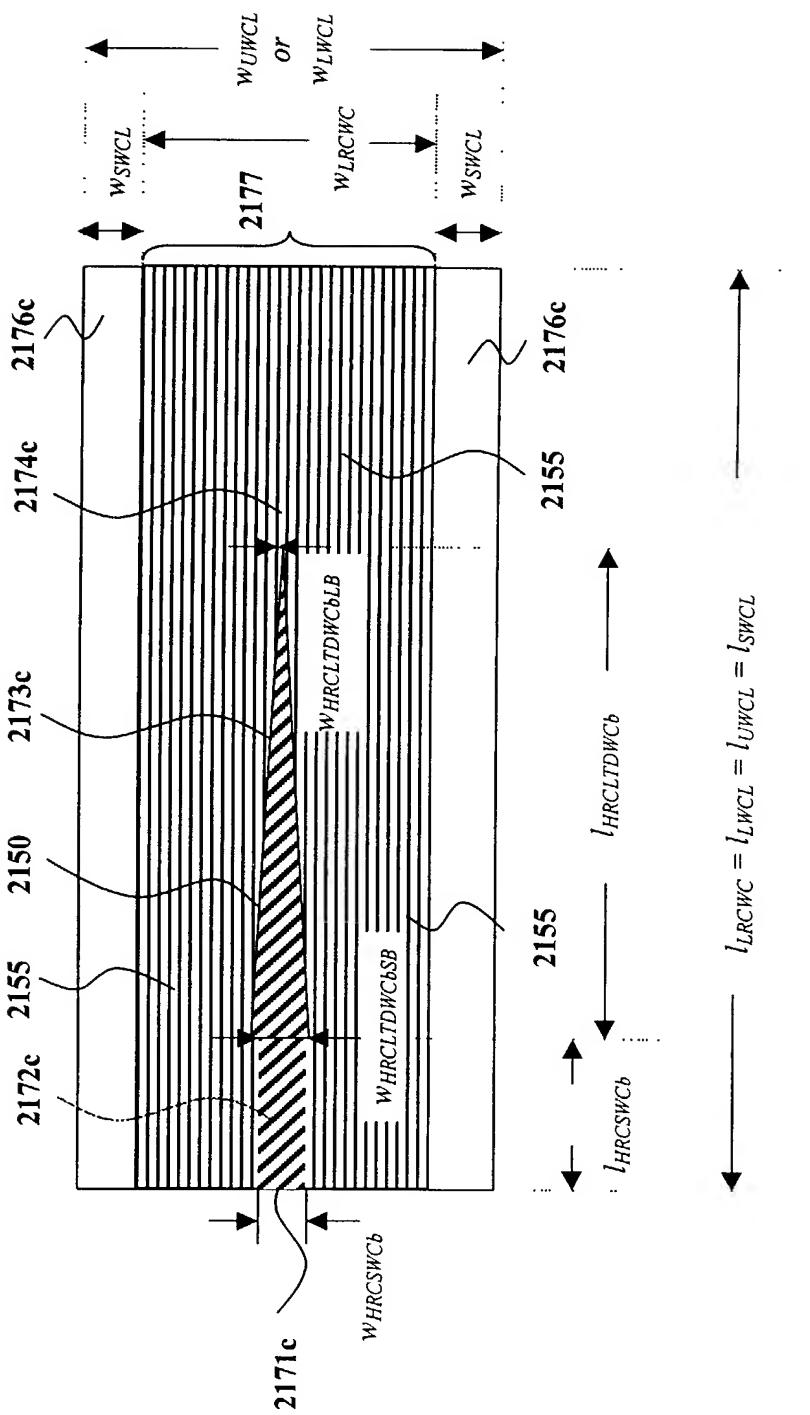


FIG 40A



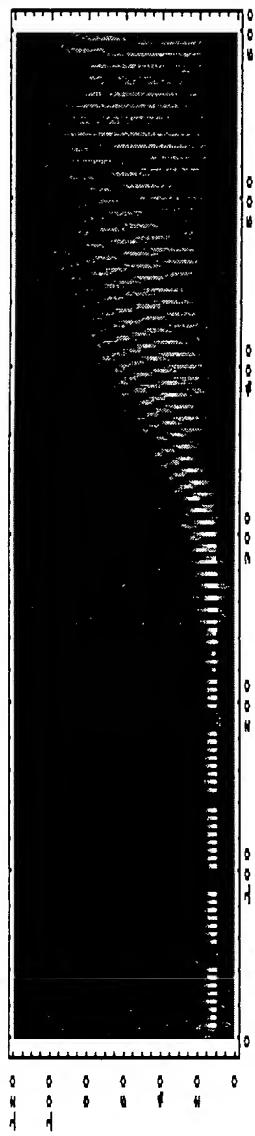
Top view

FIG 40B

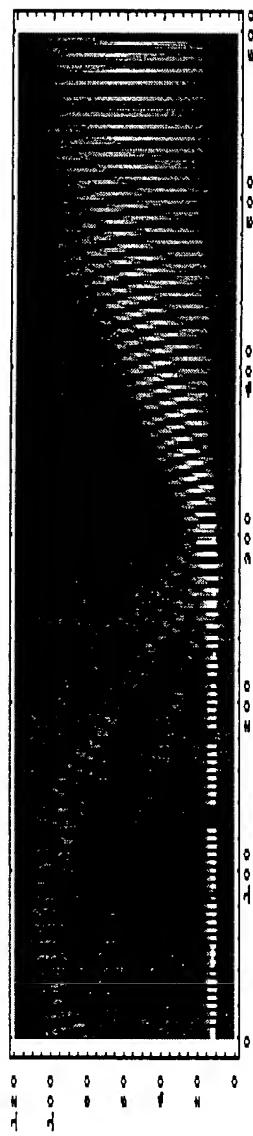


Top view

**FIG 40C**

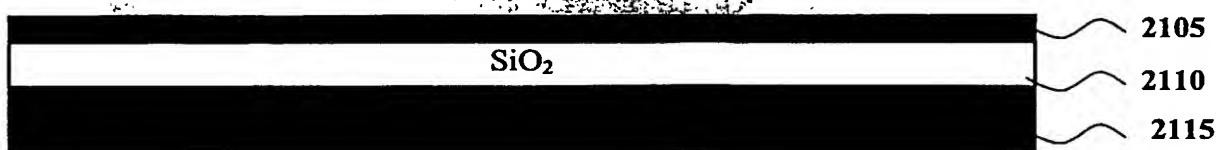


Taper side launching

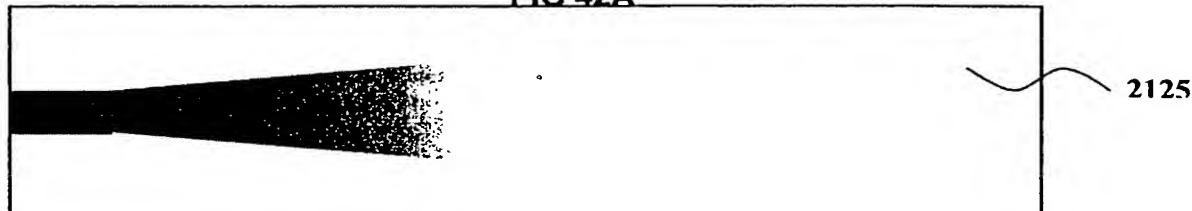


GRIN guide side launching

FIG 41

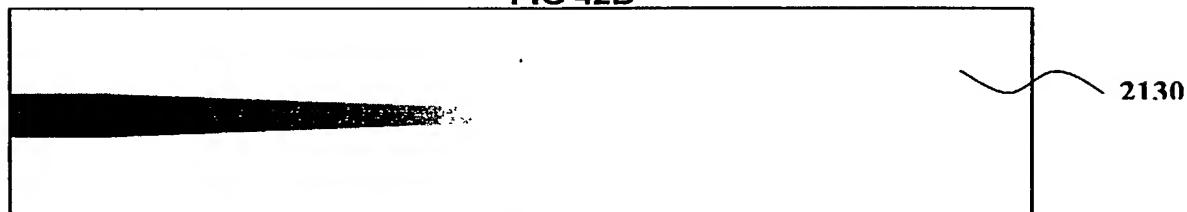


**FIG 42A**



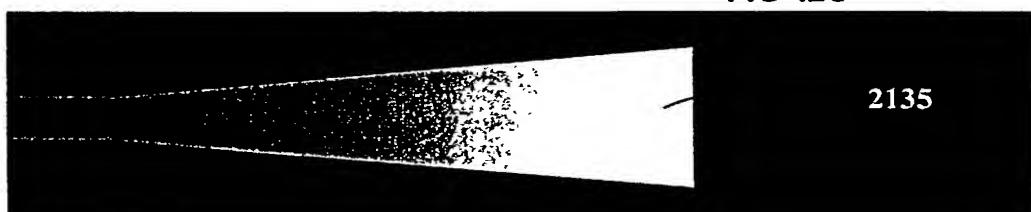
Mask top view

**FIG 42B**



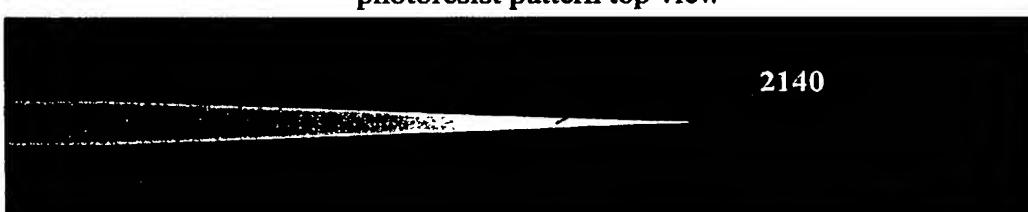
Mask top view

**FIG 42C**



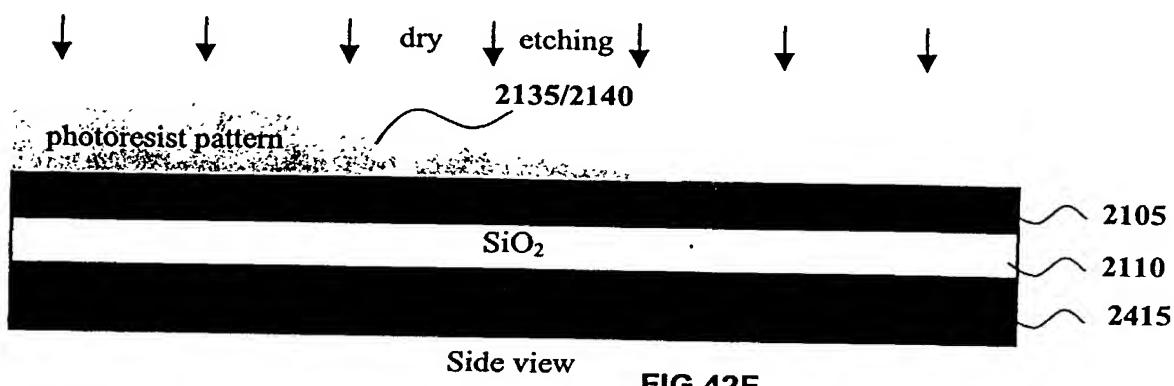
photoresist pattern top view

**FIG 42D**



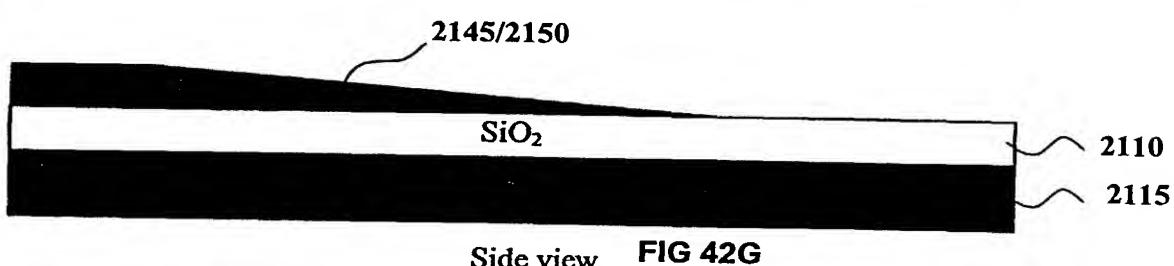
**FIG 42E**

photoresist pattern top view



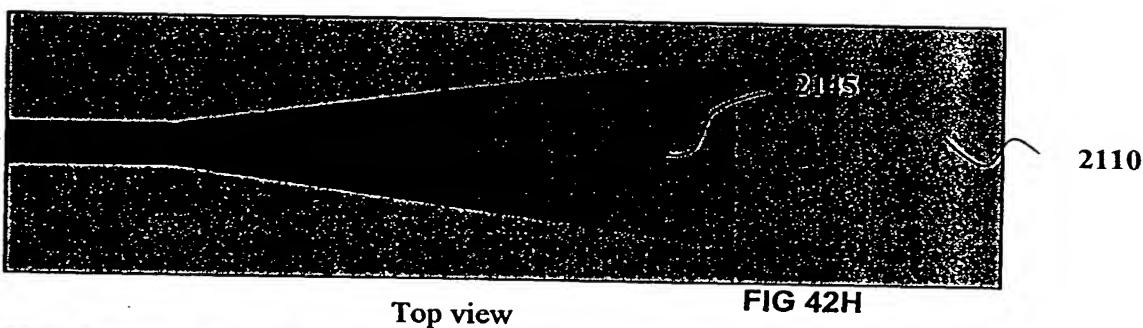
Side view

FIG 42F



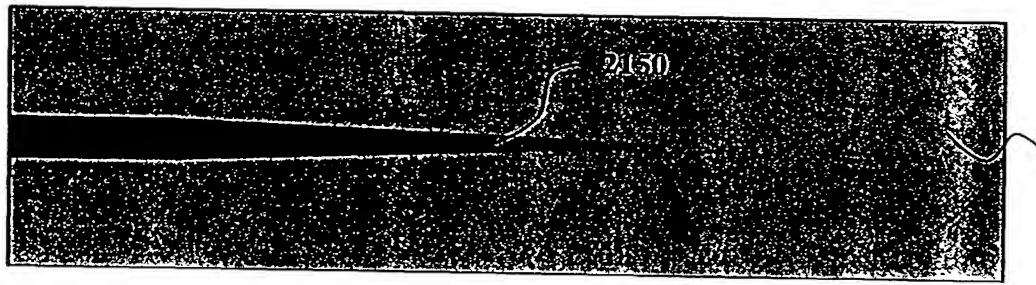
Side view

FIG 42G



Top view

FIG 42H

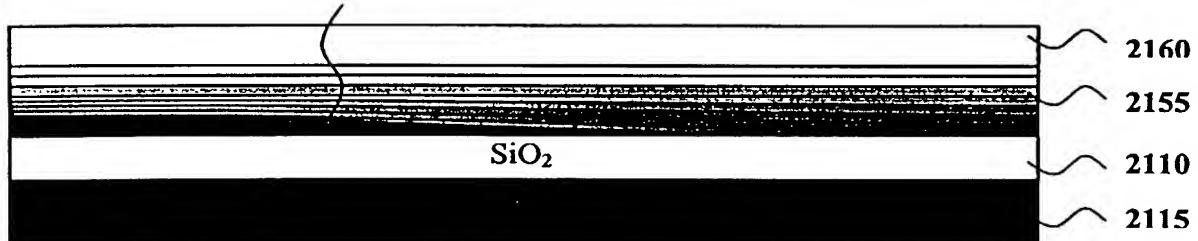


Top view

FIG 42I

Atty. Docket No.: 021040-000300  
Applicant: Yan Zhou and Seng-Tiong Ho  
Title: INTEGRATED PLANAR COMPOSITE COUPLING STRUCTURES  
FOR BI-DIRECTIONAL LIGHT BEAM TRANSFORMATION...  
Sheet 54 of 59

2145/2150



Side view

FIG 42J

2165



mask

FIG 42K

2170



mask

FIG 42L

2145

2185

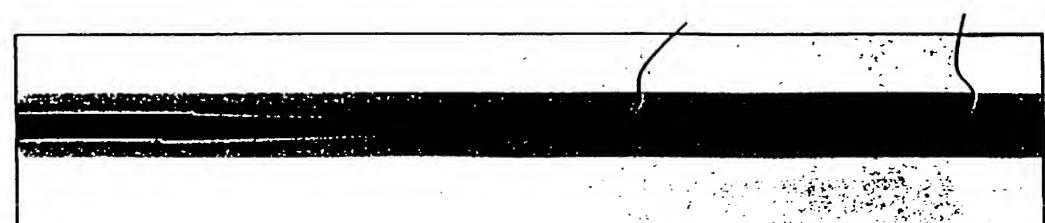


Top view

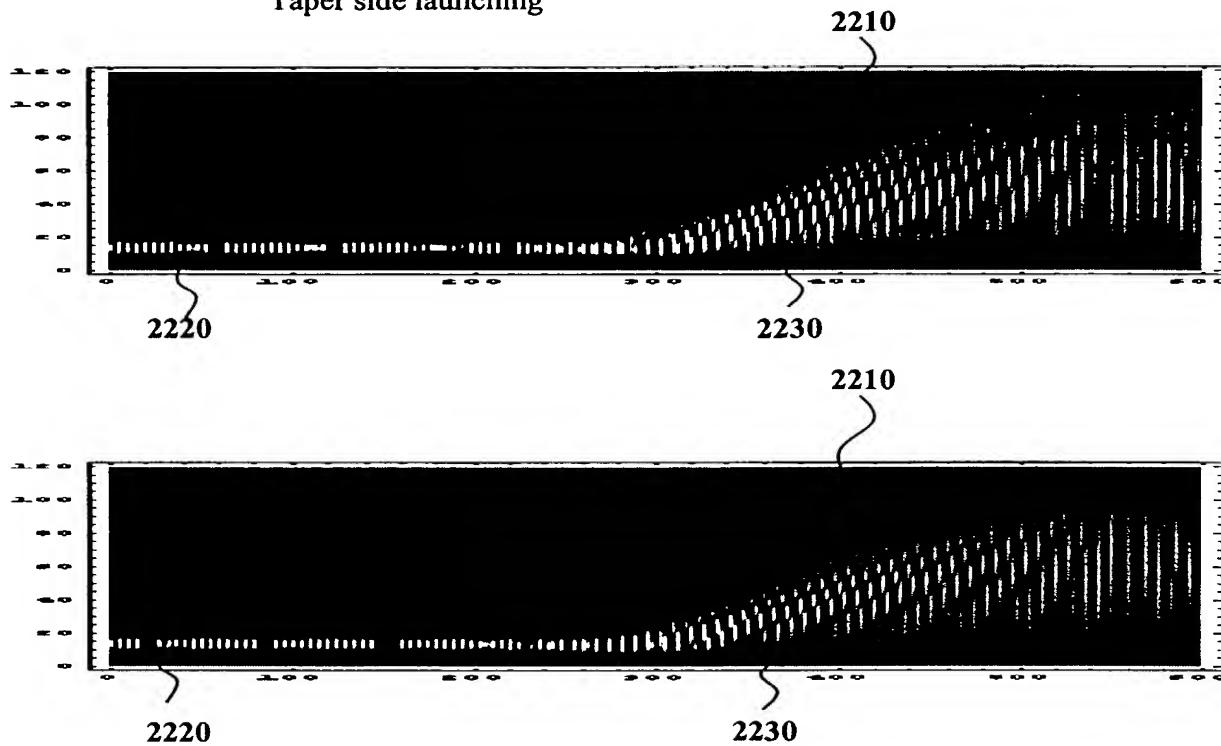
2150

FIG 42M

2190



Taper side launching



GRIN waveguide side launching

Fig 43

Applicant: Yan Zhou and Seng-Tiong Ho

Title: INTEGRATED PLANAR COMPOSITE COUPLING STRUCTURES  
FOR BI-DIRECTIONAL LIGHT BEAM TRANSFORMATION...

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FIG 44A

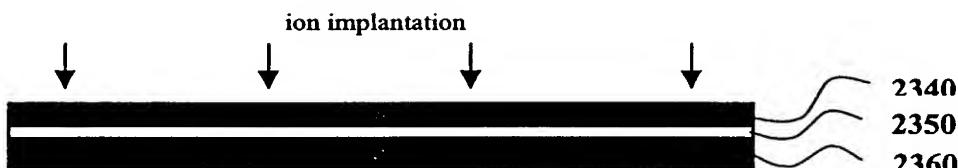
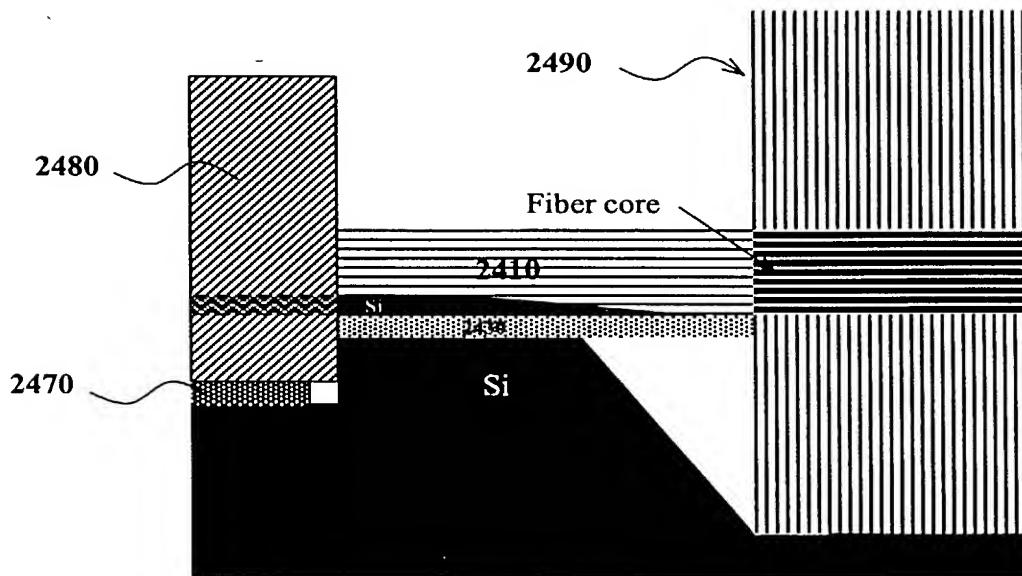
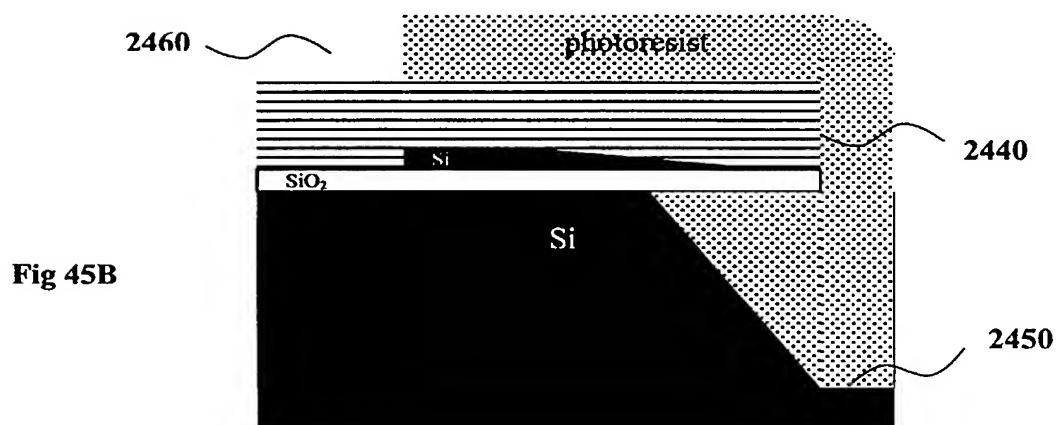
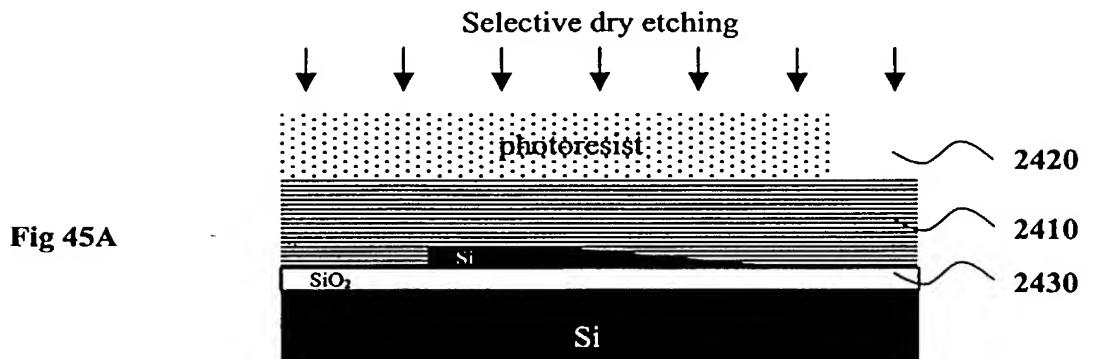


FIG 44B



FIG 44C



**Fig 45C**

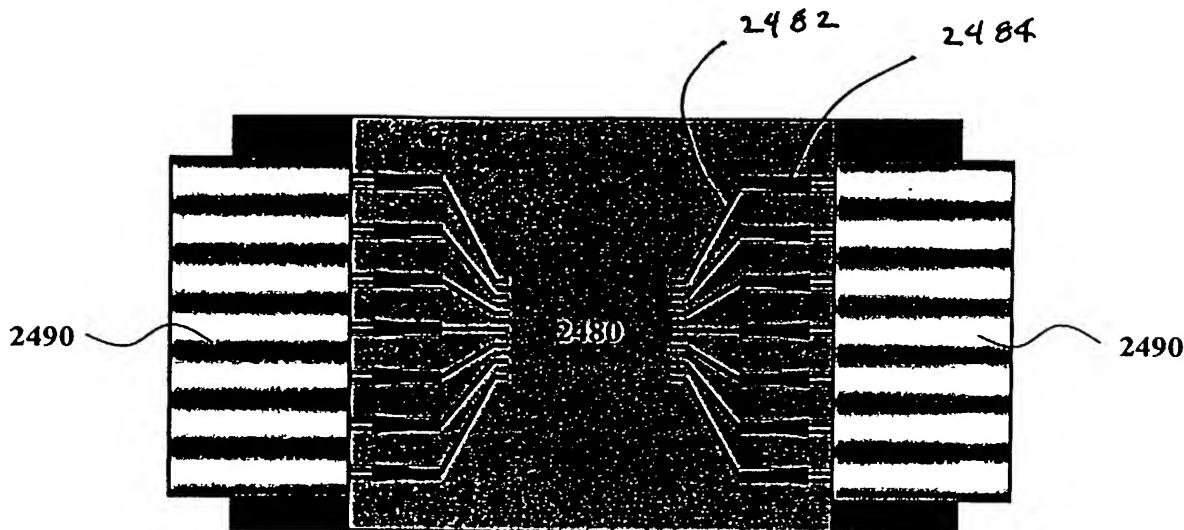


FIG 46

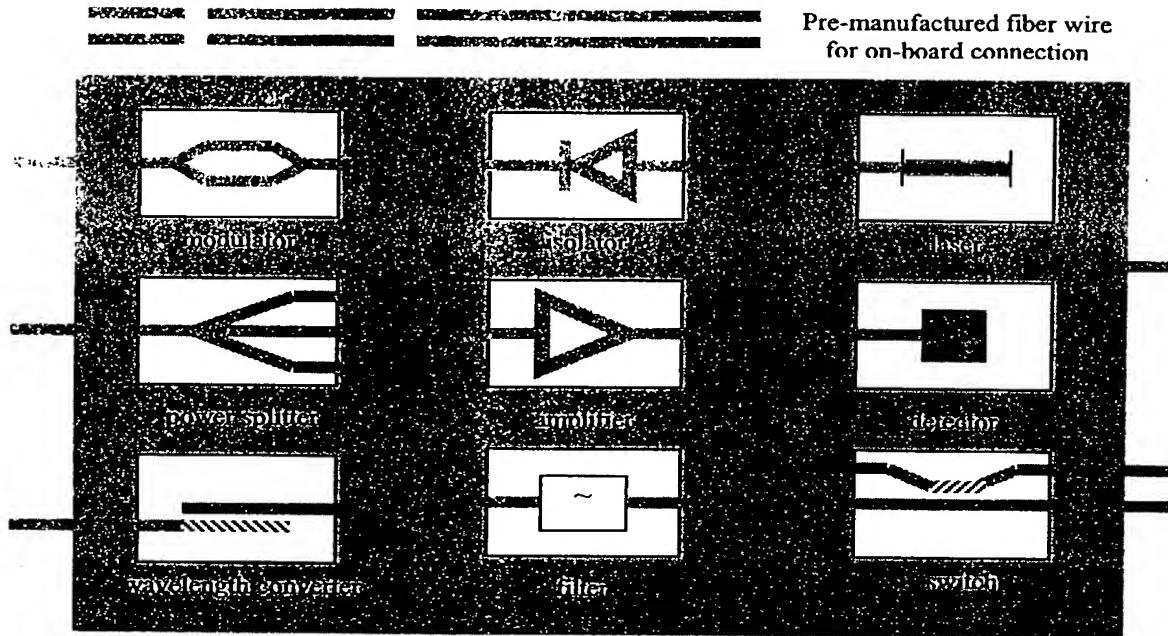


FIG 47